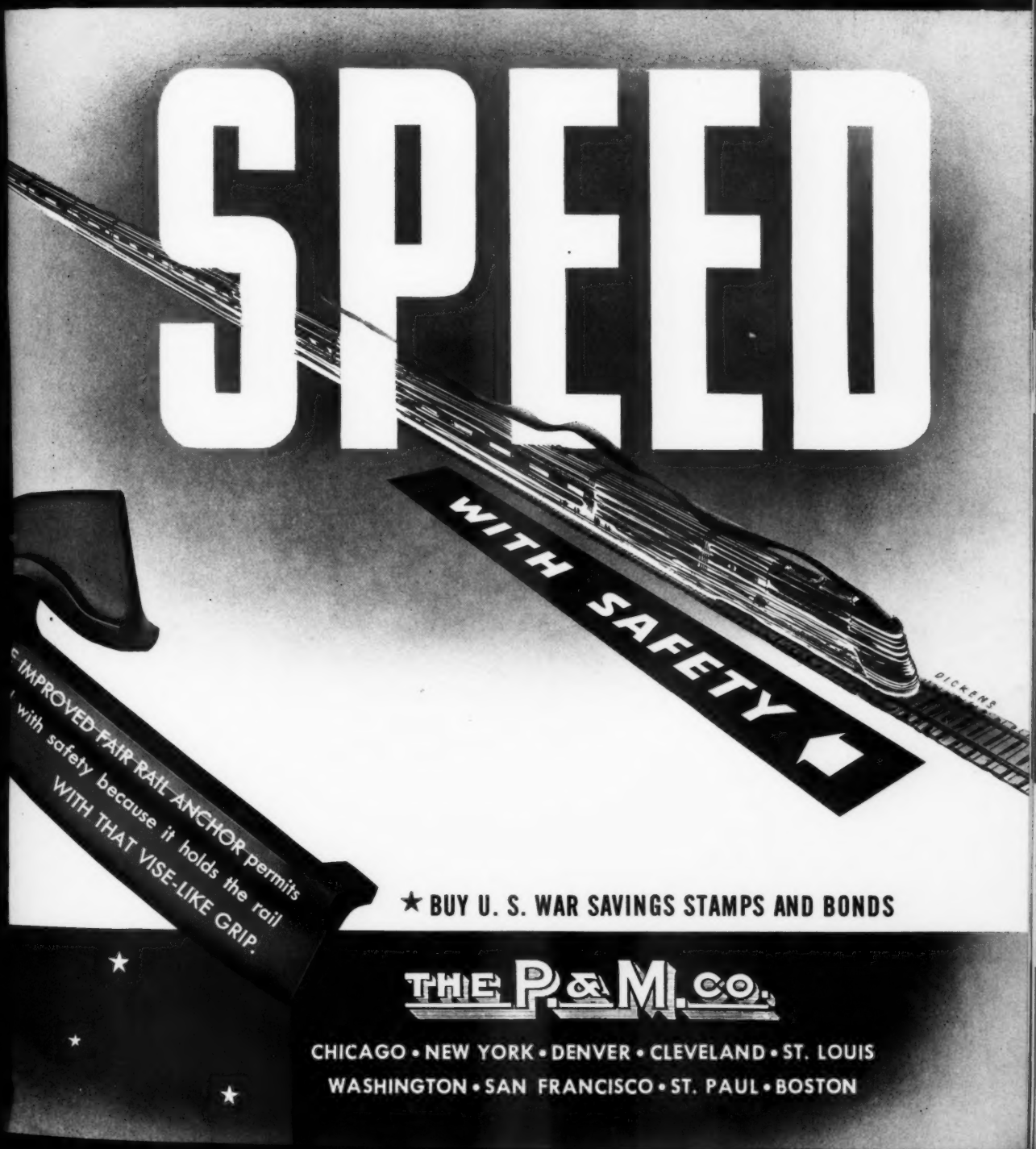

SPEED
WITH SAFETY
DICKENS
IMPROVED FAIR RAIL ANCHOR permits
with safety because it holds the rail
WITH THAT VISE-LIKE GRIP.
★ BUY U. S. WAR SAVINGS STAMPS AND BONDS
THE P & M. CO.
CHICAGO • NEW YORK • DENVER • CLEVELAND • ST. LOUIS
WASHINGTON • SAN FRANCISCO • ST. PAUL • BOSTON

Reliance HY-CROME *Spring Washers*

STANDARD

HY-CROME

DEFLECTED

1920 ——— 1942

- Many gadgets for use on track bolts have come and gone since the Standard **HY-CROME** Spring Washer was originally submitted to the American Railroads over 20 years ago.
- Its ready acceptance and commendable service was a big step forward in spring washer practice at that time.
- It satisfactorily meets the present **AREA** Specification requirements and is now in use in Track Construction by most of the Class A Railroads of the world.
- Improved manufacturing methods and heat treating practices have kept it in the lead and now doing its part in the War Effort.

● ● ●

Every good wish for the success of the Road Master's Convention and the Track Supply Association Exhibit.

Eaton Manufacturing Company

RELIANCE SPRING WASHER **DIVISION**

MASSILLON, OHIO

New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

They ride *before they roll*

From the assembly floor of the tank arsenal the finished tank goes to the delivery point—by rail. From widely-scattered production centers, materials and parts are carried to the places of assembly—by rail. And so on, through every phase of production, back to the raw materials, the railroads are playing an essential part. The war production program has brought America's railways the biggest job in their history.

In spite of difficulties and shortages of needed supplies and equipment, the job is being done. As output of fighting equipment steadily rises, a generous portion of the credit must go the the railways.

Bethlehem has long supplied steel products as well as a number of specialties to railways. Rails and accessories, track equipment, wheels and axles, plates and other Bethlehem products are today helping the railways of America to carry troops, deliver tanks and trucks, haul parts and materials to airplane assembly plants, and in countless other ways perform their vital role in all-out war production.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

BARCO TYTAMPERS

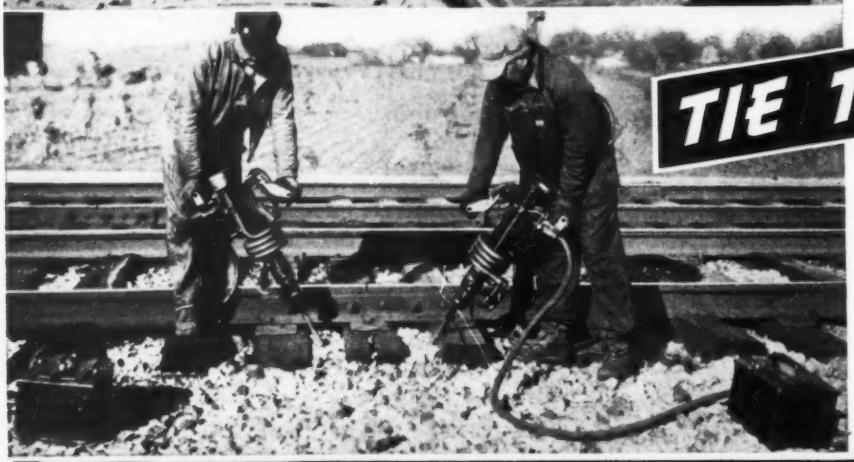
All Year Operation

ICE BREAKING

One BARCO tytamper will break up all of the ice four men can remove.

CRIB BUSTING

BARCO tytampers loosen cemented or frozen ballast quickly and easily.



TIE TAMPING

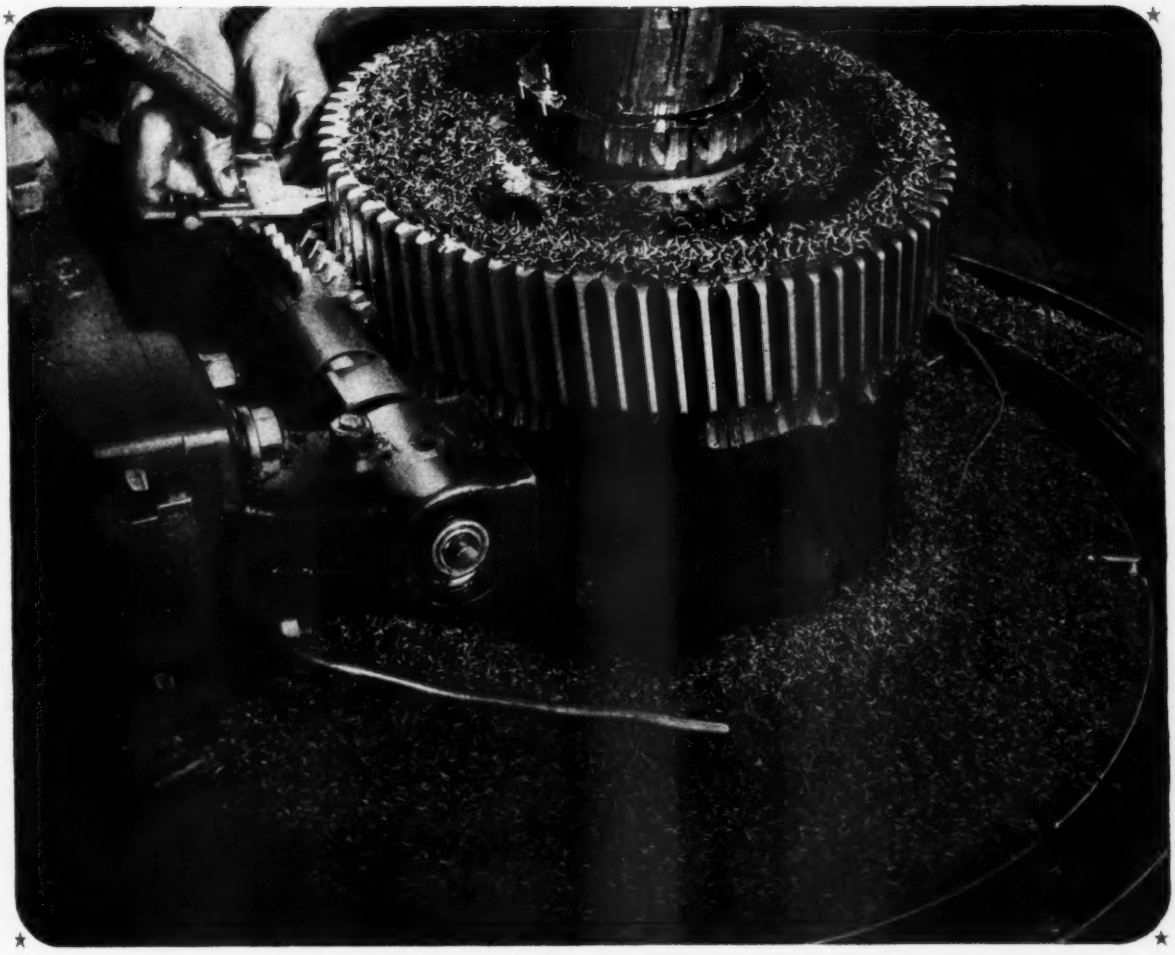
On 88 Railroads—6 years' satisfactory service.

BARCO MANUFACTURING COMPANY

1805 W. Winnemac Ave. NOT INCORPORATED Chicago, Illinois

In Canada THE HOLDEN COMPANY, LTD.

Montreal — Moncton — Toronto — Winnipeg — Vancouver



KEEP 'EM CUTTING . . AND SAVE THE PIECES

IN this war, machine tools on the average are cutting away steel at a rate more than 12 times faster than in 1918. That's production—keep them cutting!

Keep them cutting *faster* by selecting tool steels more closely suited to the job. Case after case in our files show increases in feeds, speeds, or pieces per grind—increases, often, of 50% and more—when the *right* tool steel went to work.

Keep them cutting *constantly* by knowing the best alternate tool steel for each job. Know it, and know its performance, as insurance against a time when your first-choice steel may be short in supply.

And save the pieces! Every particle of steel, especially High Speed Steel, is important, and much critical alloy material can be saved for re-use if proper methods of reclamation and classification are employed. Let our Service Staff help with your problems of tool steel selection, treatment, use and salvage.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

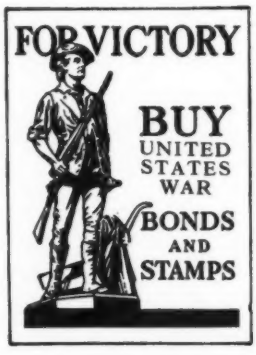
Forward March!

America is on the March!

On battle lines and transport lines . . . in factories, on farms, in homes and schools . . . every American is in this fight.

The American Railroads are providing the quickest, most amazingly efficient transportation the World has ever seen . . . freight and passenger trains are speeding over the rails, bringing a steadily increasing stream of vital war supplies, men and munitions toward far-flung battle lines.

Quietly, efficiently, Woodings-Verona Spring Devices are helping the onward march, by safeguarding by day and night thousands of miles of track on the Nation's railroads.



WOODINGS-VERONA TOOL WORKS

SINCE 1873 VERONA, PA. Offices Principal Cities CHICAGO, ILL.

★ ★ ★ ★ ★ ★ ★ ★

PRESSURE-CREOSOTED PILING helped hang up a new speed record for permanent construction here

Construction of this 700-foot pier illustrates how well pressure-creosoted wood meets requirements for speedy and permanent construction.

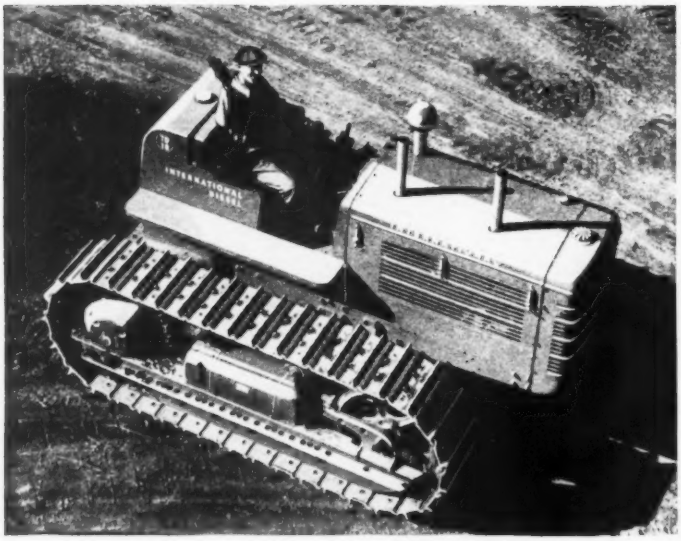
Spurred by the slogan, "700 feet toward victory," the George W. Rogers Construction Company crew drove 42,700 feet of pressure-creosoted piling (part of it through rip-rap), added framing and deck, and completed the job in a world-record-breaking 43 days. Normal construction time is 90 days, and the best previous war-time record was 68 days.

For years, pressure-creosoted wood has been first choice with experienced engineers on jobs like this, and the current shortage of other permanent construction materials is vastly expanding this already well-established use. Experience in teredo-infested waters has proven that proper pressure-treatment gives dependable and permanent protection. Pressure creosoted wood is strong, resilient and durable, needs no surface coating, and is not subject to corrosion or spalling.

Pressure-creosoted piling, furnished by the Wood Preserving Division of Koppers Company, is in use not only in docks and piers, but in foundations of bridges, stacks, large buildings, heavy machinery, grain elevators, homes, and other important structures, all over the country. If you have a foundation problem, ask for our new piling bulletin.

WOOD PRESERVING DIVISION
KOPPERS COMPANY
PITTSBURGH • PENNSYLVANIA

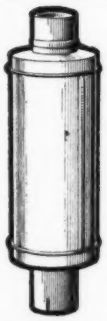
Use KOPPERS products



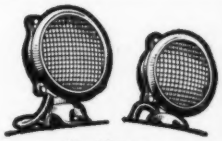
MAKE YOUR TRACTRACTOR EXTRA TOUGH WITH THESE VICTORY ATTACHMENTS

MACHINES take an extra dose of bruising in times like these. There's vital work to do—and it must be done now! If you operate an International TracTracTor, your hauling, pushing, and pulling is being handled by one of the toughest things that crawls. It's good to know your tractor can take punishment without being babied every step of the way. And here is something else that's good to know! You can make your TracTracTor extra tough and do extra hours of work every day with the help of International Victory attachments.

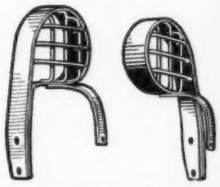
What are Victory attachments? Take a look at the drawings on this page. These attachments are added to TracTracTors built for the Victory Pool, released to eligible users by the WPB. You can bring your TracTracTor up to Victory specifications by ordering the attachments you need. See the nearest International Industrial Power dealer.



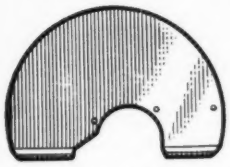
Exhaust muffler attachment.



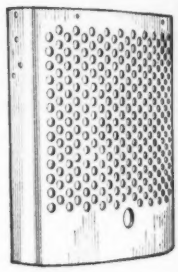
Head lamps. Permits night work.



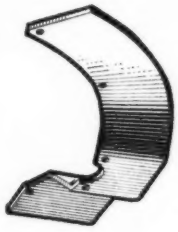
Head lamp guards. Protects lamps from breakage.



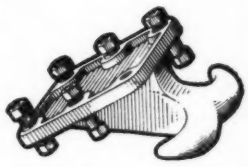
Front idler shield attachment. Prevents damage from stones.



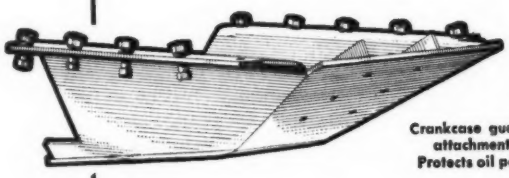
Radiator guard. Extra toughness for extra tough work.



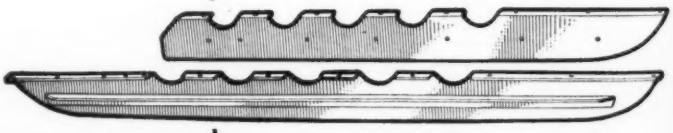
Sprocket rock deflector. One for each side.



Front pull hook attachment. Handy in many ways.



Crankcase guard attachment. Protects oil pan.



Heavy duty track roller shield attachment.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL Industrial Power

Of the forty major railroads competing in Group A, the Eastern District of the Union Pacific System has been awarded the Harriman Gold Medal for the operating year 1941, having recorded the lowest total weighted casualty rate of any railroad in the Group

for Outstanding Safety!

Excerpt from Citation, Harriman Medal award

"According to the records of the I.C.C., the Union Pacific has, of Jan. 1, 1942, accumulated 5,762,000,000 passenger miles without a passenger fatality in a train or train-service accident. This is the best record in Safe Transportation thus far established."

One of the principal means for assuring maximum safety on the Union Pacific is use of Detector Cars operated by Sperry For the past 3 years, the U. P has employed 2 such cars testing continuously, and has thus been able to effect timely removal from track of rails grown defective in service.

SPERRY RAIL SERVICE • HOBOKEN, N. J. • CHICAGO, ILL.

★ ★ ★ ★ CHICAGO PNEUMATIC NEWS ★ ★ ★ ★

WARTIME MAINTENANCE AIDED BY CP TOOLS

WRENCHES, RIVETERS, WOOD BORERS, SPEED TRACK AND BRIDGE REPAIRS

Greatly Increase Crews' Efficiency

NEW YORK (CP) — War-burdened railroad maintenance executives find CP Pneumatic Tools the answer to many problems demanding speed and efficiency. For example, on wooden trestle work, the CP Pneumatic Wrench (impact type) gives many times the speed of hand wrenches. In rivet driving, the stamina, speed and ease of handling make the Boyer Riveting Hammer outstanding. When long, accurate bolt holes are needed in timbers, valuable time is saved by using CP Rotary Wood Borers. And for compacting concrete, the CP Concrete Vibrator does a better job in less time. Write for literature on CP tools.

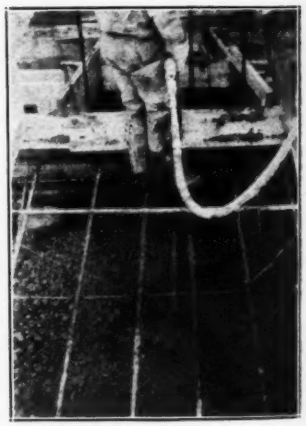
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 E. 44th St., New York, N. Y.

↑ **NUTS, BOLTS, STUDS, LAG SCREWS, ETC.**, are run on or off "in the wink of an eye" with the CP Pneumatic Wrenches (impact type). Handle nuts up to 1¾" bolt size. Powerful rotary motor, simple, efficient, and economical. Light in weight, little vibration, ease of handling—minimize operator fatigue. No torque, safer to use.

↑ **FOR BRIDGE REPAIR** and maintenance work there are models of the CP Boyer Riveting Hammer designed to drive rivets from ⅝" to 1¼". Short overall length, light weight, rapidity and power of blow and, particularly, outstanding ease of handling, make these hammers most popular.

↑ **ROTARY WOOD BORERS** save valuable time in drilling bolt holes in piers, bulkheads, trestle work, tie boring (screw spikes), wooden barges, etc. Three sizes, capacities 1" to 4". All sizes reversible.



↑ **CONCRETE VIBRATOR** for compacting concrete in protection walls, concrete slabs, bridge piers, culverts, etc. Also CP Pneumatic and Electric Vibrators for mass concrete.

CHICAGO PNEUMATIC

PNEUMATIC TOOLS

ALSO: Air Compressors, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

DRILLS
WRENCHES
FLUE ROLLERS
RIVETERS
GRINDERS
CHIPPERS

GOOD *Track Maintenance* WAS NEVER MORE IMPORTANT IN ALL HISTORY

The "Crawl-Air" Compressor

Ingersoll-Rand compressed air equipment is playing an important part in the vital job of maintaining our network of railway track. Track crews fully equipped with these modern machines are doing bigger and better jobs—and doing them quicker and with less effort.

Advantages of I-R Off-Track Compressors

Operate Many Combinations of Air Tools
Do Not Interrupt Traffic
Are Readily Portable
Keep Up With the Work
Give Uninterrupted Service

Advantages of I-R Lightweight Air Tools

Speed Up Work
Reduce Operator Fatigue
Have Low Air Consumption
Maintain Track Better
Do Many Types of Jobs

Spaltamper Compressor

THE I-R LINE IS COMPLETE

Air Compressors	"Utility" Air Hoist
Tie Tamper	Wood-Borer
Spike Driver	Paving Breaker
Rail Drill	Jackhamer
Track Wrench	Impact Wrench
Multi-Vane Grinder	Riveter
Chipping Hammer	

Atlanta Birmingham Boston Buffalo Butte Chicago Cincinnati Cleveland Dallas Denver Detroit Duluth El Paso Hartford Houston

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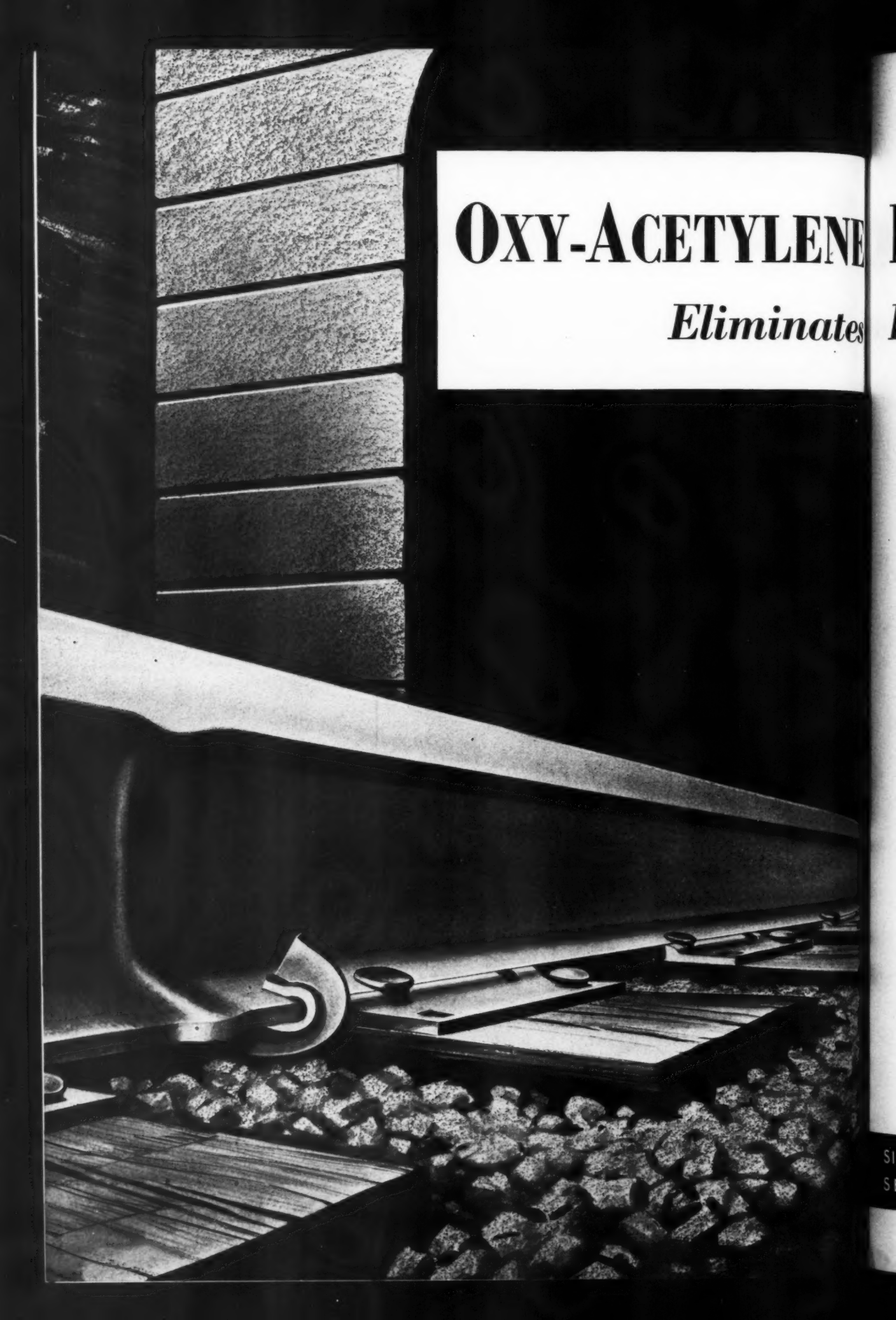

OXY-ACETYLENE
Eliminates

PRESSURE-WELDED RAIL..

Batter and Joint Maintenance

WHEN Oxweld's pressure-welding method is used to join rails, a continuously smooth surface is provided, maintenance of joints and signal bonds is done away with, and the possibility of rail end batter is eliminated.

Pressure-welded rail is being used increasingly in a variety of locations. In tunnels, for example, the smooth surfaces of pressure-welded rails are free from depressions and pockets that catch moisture, dripping water, and gases that cause rail corrosion. Difficult maintenance work is thus greatly reduced.

When rail on bridges is joined by pressure welding, the smooth-riding surface substantially reduces impact. Pressure-welded rails have also proved their worth in station platforms where traffic is usually heavy and maintenance difficult. Once the rails are laid—and covered, if desired—the matter of joint maintenance can be forgotten. These and other advantages of pressure-welded rail make it particularly suitable not only in these locations, but also in road crossings, on overhead structures, and in open track, where maintenance conditions are difficult, and in addition, it should be considered for use in lead rails through switches.

Your Oxweld representative will be glad to give you the latest information on how pressure-welded rail can be used to advantage on your road.

THE OXWELD RAILROAD SERVICE COMPANY

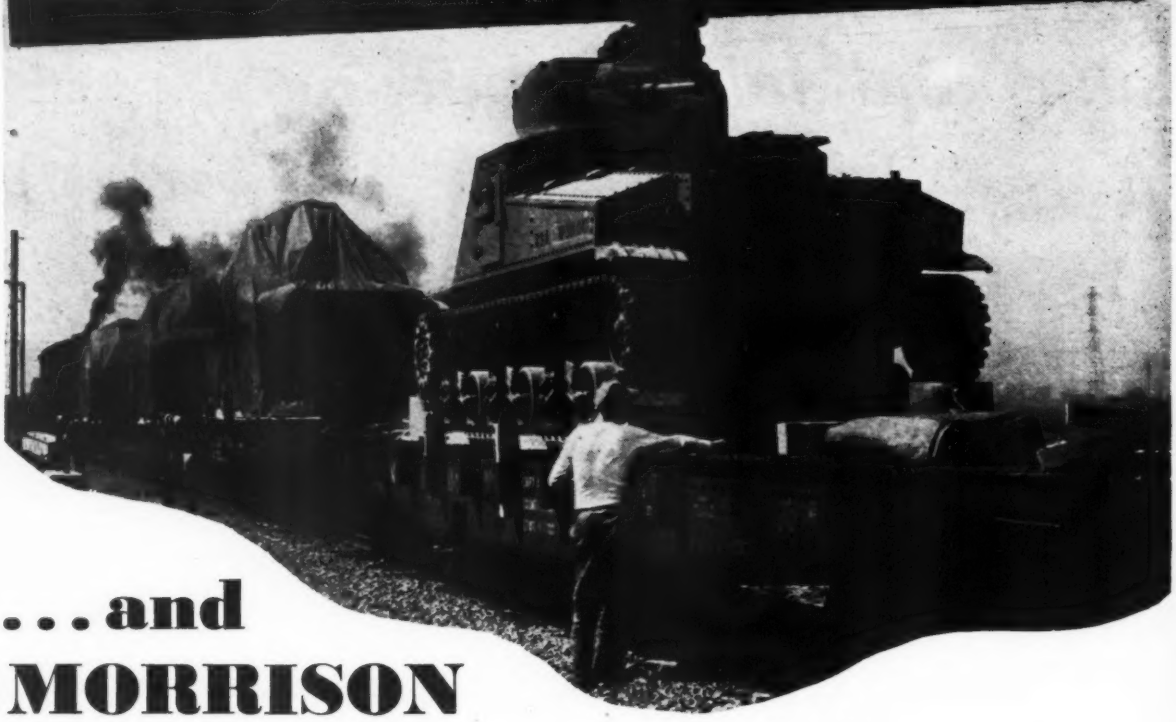
Unit of Union Carbide and Carbon Corporation

Carbide and Carbon Building UCC **Chicago and New York**

Since Oxweld's equipment for pressure welding rails is limited, welding schedules should be planned now in advance so as to obtain the full utility of available equipment through the fall and winter months, and thus to have your next season's pressure-welded rails ready when needed.

SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

Heaviest Traffic in History... and the TRACKS MUST NOT FAIL!



...and MORRISON Is Ready With Valuable Services!

1. Maintenance of frogs and crossings by electric welded repairs in track under traffic. More than ten years of guaranteed service have proven the worth of Morrison Metalweld Process.

2. Complete service in welded repairs to bridges, signal towers and other steel structures requiring maintenance and reinforcement.

3. Cleaning and painting of steel bridges by trained personnel working with specially designed equipment and quality materials.

4. Osmoplastic groundline preservative treatment for standing timber piles and transmission line poles. Osmoplastic is a time-tested ready-mixed composition of coal tar and recognized preservative salts.

MORRISON RAILWAY SUPPLY CORP.

RAILROAD REPRESENTATIVES

Morrison Metalweld Process, Inc. — Osmose Wood Preserving Co.

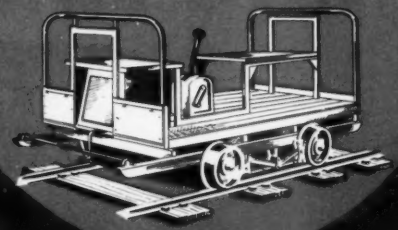
Buffalo Sheeting & Painting Co.

50 Church St. NEW YORK CITY

GENERAL OFFICES BUFFALO, N. Y.

14 E. Jackson Blvd. CHICAGO, ILL.

GIVE VICTORY THE RIGHT OF WAY— put your section cars on TIMKEN BEARINGS



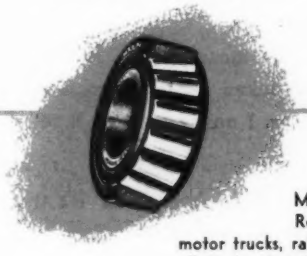
Friction bearings have no place in railway section cars any more than in streamlined trains. The former need the speed, endurance and economy of Timken Tapered Roller Bearings just as much as the latter.

As war program transportation increases and trains get heavier and heavier, trackage will require more and more attention, putting an added burden on maintenance equipment; but Timken Bearing Equipped section motor cars and trailers will prove equal to all demands.

They are not (1) handicapped by friction; (2) threatened by radial, thrust and combined loads; (3) constantly in need of lubrication; (4) subject to wheel breakage.

Like friction bearing locomotives and passenger cars, section motor cars and trailers equipped with friction bearings are obsolete before they go into service. This is a point for car manufacturers and railway maintenance officials to keep in mind.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

"Short Handed"

"Boss, I hear that Jim ——— is leaving to enter the service," said the star salesman to his railway sales manager.

"That's true, Bill," replied the railway sales manager. "He's going into the air corps. He's the fourth man to go from our sales staff."

"That's hitting us pretty hard, isn't it?"

"Yes, Bill, it is. But I'm proud that we have so many men whom our country wants."

"That's so, but it's certainly making it tough for those of us who are left. How are we going to maintain our contacts with our customers?"

"It's up to you and me to tighten our belts another couple notches and work that much harder. You'll have to take over most of Jim's accounts."

"But I've got more than I can handle now, Boss."

"I know it, Bill, but it's all we can do. You'll have to hit the ball harder than you've ever done before."

"I'm willing to do that, but even then I can't get around to see these railroad officers as often as I ought to."

"I realize that, Bill, and we're planning to give you some help."

"How's that?"

"Through more advertising. We're planning to increase our schedule in *Railway Engineering and Maintenance*."

"Gee—that's great. It'll fill in between my calls, telling our friends what we have to help them and keeping our name before them."

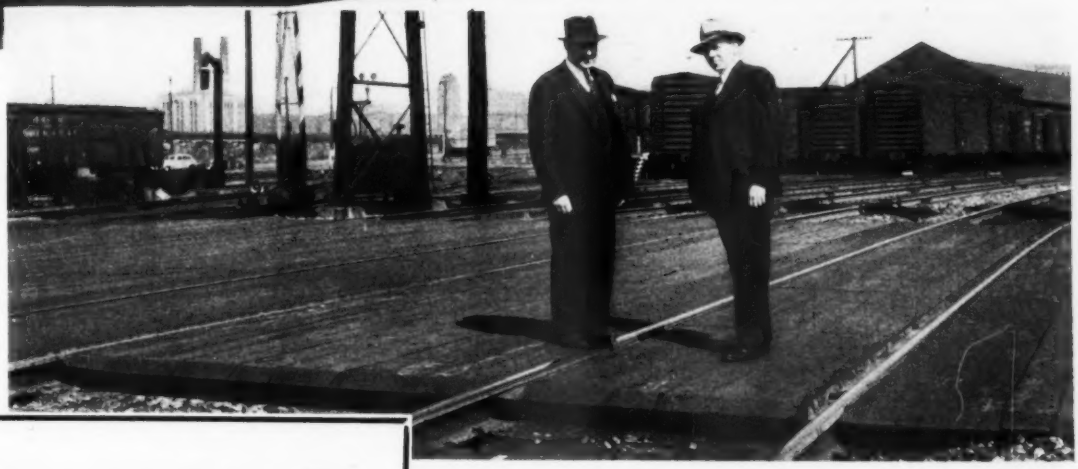
"That's right, Bill. It'll render a real service to them and, at the same time, will prevent them from forgetting us at a time when they have so much on their minds that it's so easy to forget."

"That's certainly true in these days. And don't forget, Boss, that that magazine takes our story to a lot of men—important ones, too—whom I never get to. It reaches *all* of them."

"I know that's true, Bill—I've checked it. It's the paper of the field."

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

Smooth YET STURDY AS THE TRACK



11 Years Service WITHOUT Maintenance Expense

That's the record of many Moss Ready-Made Crossings installed back in 1931. They're carrying some of the heaviest and densest truck traffic in the country, too!

After 11 years, Moss Crossings are just as smooth and just as firmly in place as the day they were laid—and railway maintenance men say they're good for at least 10 years' additional service.

Moss Ready-Made Crossings

No Sir, these crossings are not wartime substitutes. They'll be smooth for the duration . . . and then some! Moss Ready-Made Crossings are furnished in light-weight, creosoted sections made of *Black Gum* and ready to fit in place. They are designed for heavy duty and they're made to resist abrasion and wear.

Check these features:

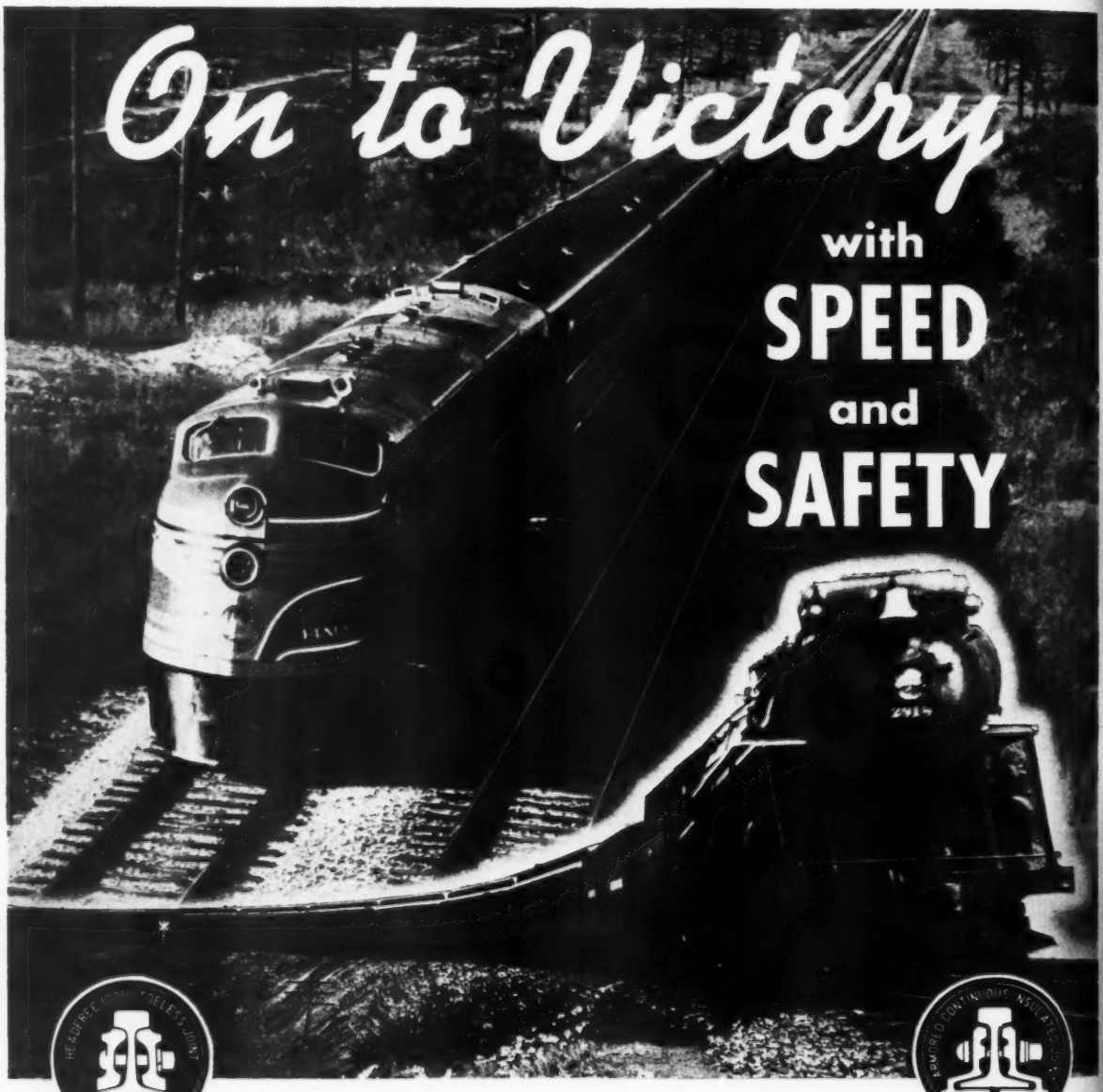
- ***Shipped ready to install,*** no adzing, no sawing, no fitting. Moss Crossings are built to individual plans ready for quick assembly.
- ***No special tools*** or equipment needed. Moss Crossings are easy to install. A small track gang can do the job with regular tools.
- ***Less Maintenance.*** Actual records show eleven years' service without maintenance expense and crossings good for years to come.
- ***Built for heavy duty*** of thick Black Gum timbers. Moss Crossings are as rugged as the track.
- ***Easy to remove,*** if track work is ever necessary, the light-weight sections can be reinstalled without delay and without detouring highway traffic.
- ***Full salvage value*** in the event of crossing elimination. Quickly removed, ready for use, without waste, at other locations.

Write us for descriptive circular.

The Stamp of Character MC FOUNDED 1879

T. J. MOSS TIE COMPANY

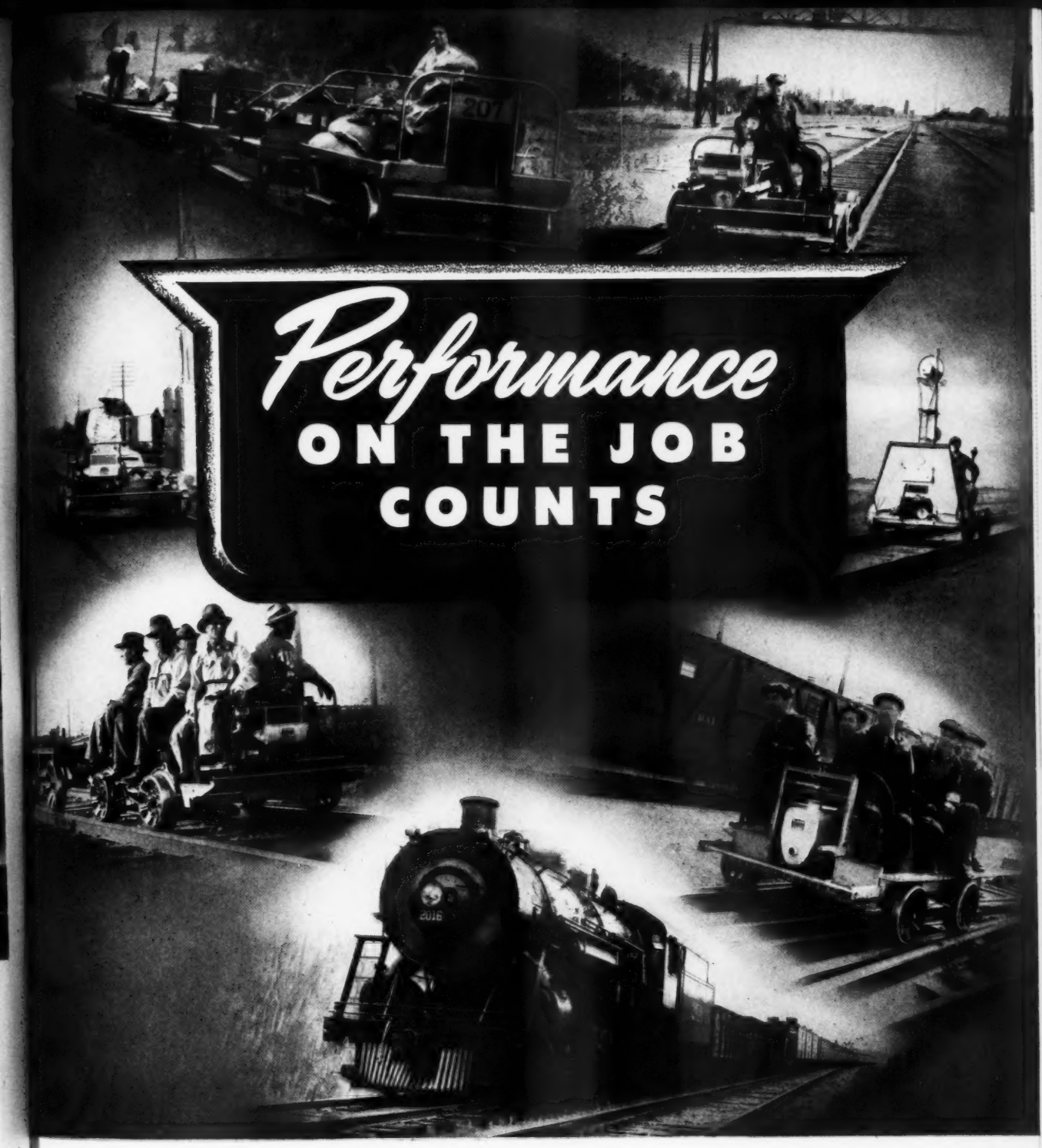
SECURITY BUILDING ST. LOUIS, MO.



MAXIMUM STRENGTH
MINIMUM WEIGHT
means
CONSERVATION OF STEEL

Save to Win
BUY WAR BONDS

THE RAIL JOINT COMPANY INC.
50 CHURCH STREET NEW YORK, N. Y.



Of All The Cars in Service Today More Than Half Are FAIRMONTS

The importance of performance on the job can not be overemphasized. All equipment must give maximum availability for the job at hand. This applies to locomotives and all the way throughout the entire line, even to motor cars.

Fairmont's complete line of modern motor cars has always given outstanding performance on the job. Because of their reserve power, dependability, and overall economy these cars are preferred by those who ride motor cars and those who maintain them.

The record of Fairmont performance is written in the books of practically every railroad; records of low maintenance, long life, and more work per day. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

Fairmont
RAILWAY MOTOR CARS

HALF-PINT HURRICANE ON WHEELS

Sure it's small. That's why they call it Worthington's Hand-i-Air Compressor. But 60 cubic foot capacity is enough for tie-tamping and most railroad jobs. And you'll find this "half-pint hurricane" is ready to deliver *more air* than many an air-wasting "big shot" that spends half its time in the repair shop.

It saves its breath. Like all Worthington Blue Brute Compressors . . . Portable and Semi-Portable . . . it's an "easy breather." The famous Feather* Valve means no back-talk on the job—no time-wasting rest cures, lower repair costs.

Combine it with Worthington's Blue Brute Rock Drills and Air Tools. They use *less air*. Together, they'll give you more WORTH from air.

Metals Scarce? Tools Hard to Get? Cash in Today on Worthington's Free Equipment-Saver

From coast to coast Worthington's Equipment-Saver is showing Railroad maintenance men how to boost production and lower costs. It points out the best ways to conserve equipment and tools. Write to Holyoke today for your copy of Worthington's EQUIPMENT-SAVER.

On the Job with

BLUE BRUTES

Says a Maintenance of Way Superintendent about his Blue Brutes—"If everything gave as little trouble as my Blue Brute Portables, I'd have the green light all the time!"

On hundreds of Army, Navy, Air Force and Ordnance projects all over the country, Blue Brutes are at work.

*Reg. U. S. Pat. Off.

Get more WORTH from air with WORTHINGTON

BUY BLUE BRUTES

Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation Harrison, N. J. Holyoke Compressor and Air Tool Department Holyoke, Massachusetts

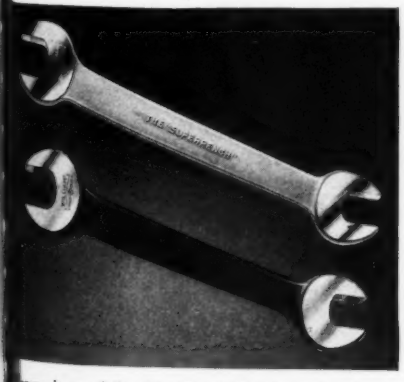
HOW AND WHY
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

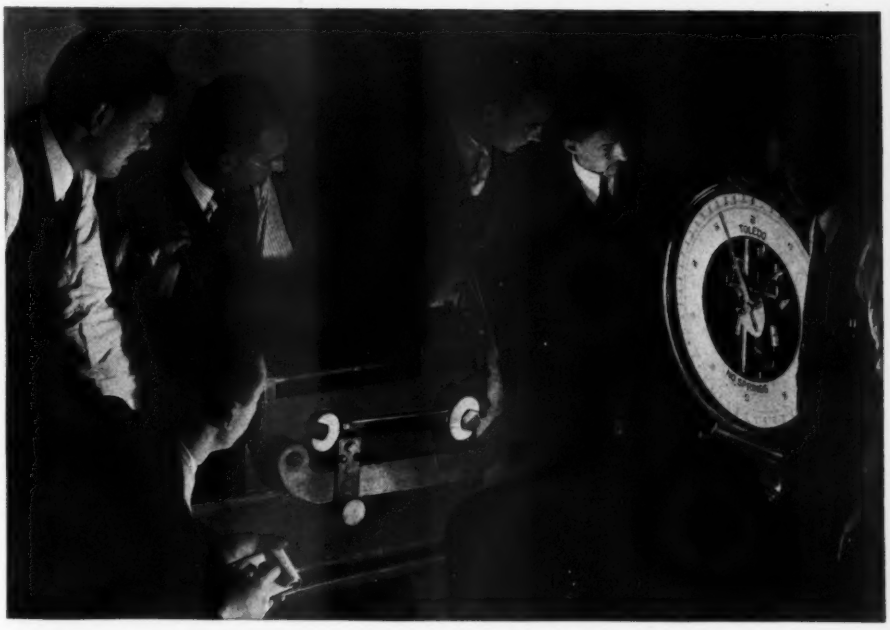
WILLIAMS' "SUPERIOR" (CARBON STEEL) WRENCHES

For some years previous to the war, the popular trend was toward replacement of this type of wrench with alloy steel tools which usually were chrome-plated and more highly finished. Today, however, material shortages and the need for critical economy makes a close examination of the relative merits of carbon and alloy steel wrenches particularly timely. Since we manufacture *both* types, we can present the following facts and figures without bias or prejudice.

Williams' "Superior" Wrenches are forged from carbon steel, specially processed to exacting specifications. These wrenches have been improved to a point where they are substantially twice as strong as the earlier carbon steel wrenches of our own manufacture. Comparative tests demonstrate that they average (throughout all patterns and sizes) 93% as strong as our corresponding alloy steel wrenches. In the popular Double-Head Engineers' pattern,



Comparison of Double-Head Engineers' Pattern of Alloy (top) and Carbon Steel wrenches. Both wrenches have same openings.



Comparative strength tests were made in Williams' Laboratory with every size and type in the carbon and alloy steel wrench lines.

"Superior" (carbon steel) Wrenches are *actually stronger* than the corresponding sizes of alloy wrenches which are of thinner design. Other patterns in the Williams' line are forged from identical dies whether of carbon or alloy steel—thus the *average* shows a slight strength advantage in favor of alloy steel.

Against this slight advantage are the following practical considerations: Alloy steel wrenches cost nearly twice as much as "Superiors"; critical alloys are needed in many items of war production where substitution is highly undesirable; in the Double Head Engineers' pattern, the thicker design of "Superior" Wrenches affords a more comfortable hand grip and a better bearing on the nut; the usual finish supplied on "Superior" Wrenches involves no critical material (such as chrome), since they are finished in baked-on enamel rather than plating.

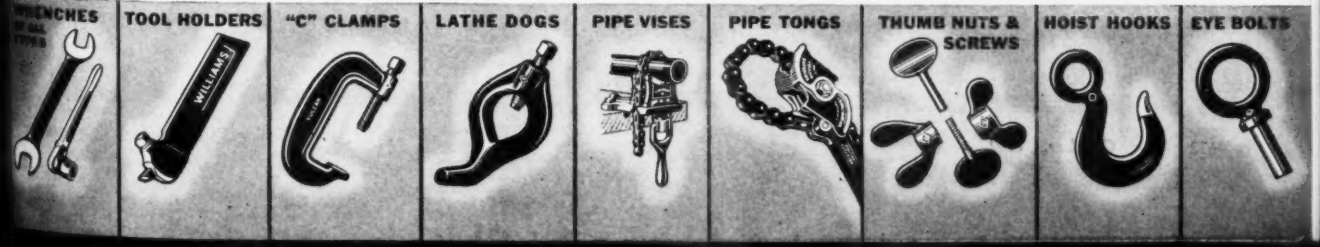
Economize with Carbon Steel Wrenches

In view of today's conditions, we strongly recommend the use of "Superior" (carbon steel) Wrenches wherever possible. For most industrial applications, any advantage in alloy wrenches is negligible. Some types of close-quarters work require the thinner heads available in the Double-Head Engineers' pattern of alloy wrenches, thus justifying their higher cost.

An informative booklet, providing comprehensive data on standard wrench types is available without charge. Write for "How to Select and Use Wrenches."

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere



Chipman

Complete

Weed Control Service

for

Railroads

Over Twenty-five Years of Experience

◆

ATLAS "A" ARSENICAL

ATLACIDE CHLORATE WEED KILLER

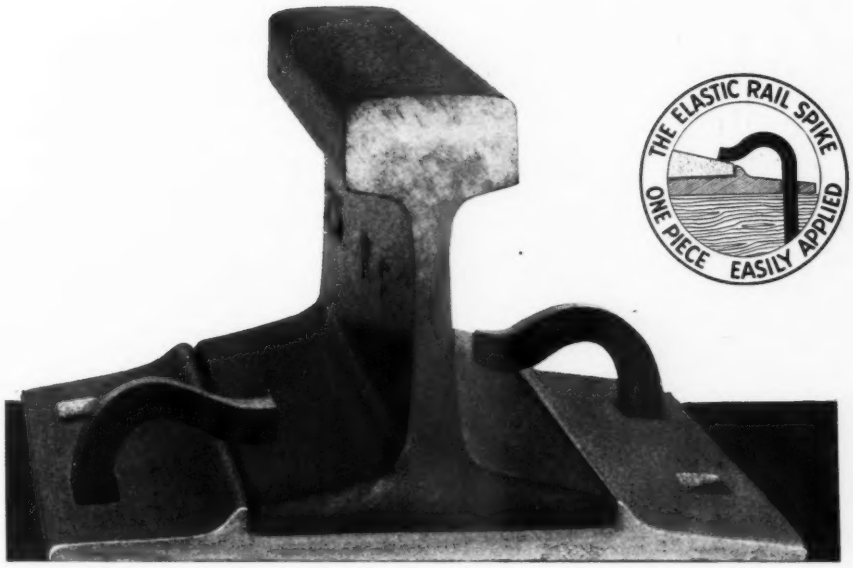
CHIPMAN CHEMICAL COMPANY, INC.

BOUND BROOK, NEW JERSEY

Chicago, Ill. • Palo Alto, Calif. • Houston, Tex. • No. Kansas City, Mo. • Winnipeg, Can.

Elastic

RAIL SPIKES



A LOOSE TIEPLATE chafes wood fibre and shortens Crosstie life. Elastic spikes keep tieplates tightly wedged under pressure between rail and tie, thus reducing tieplate penetration.

A LOOSE SPIKE needs frequent redriving which leads to spike killing. Elastic Rail Spikes remain tightly fixed in position as first driven. No redriving is required and spike killing is averted.

USE ELASTIC RAIL SPIKES AND

SAVE TIES

ELASTIC RAIL SPIKE CORPORATION

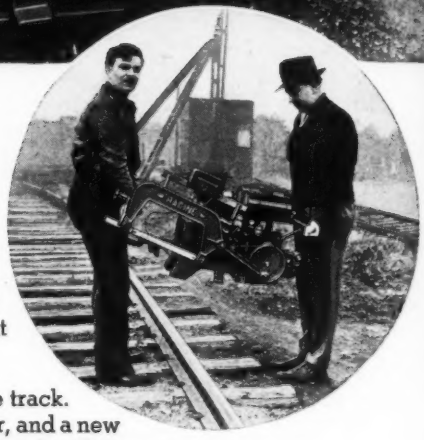
Affiliate of Bernuth, Lembcke Co., Inc.

420 LEXINGTON AVENUE NEW YORK, N. Y.

Houston » Pittsburgh » London

RACINE PORTABLE SAWS

"cutting On the Track"



Racine offers a simple, faster and safer method of cropping rails on the track. Battered down rail joints or split ends need refacing and it is important that this job be done without delaying rail traffic and without scrapping usable rail.

With RACINE portable saws you can do the whole job on the track. The rail ends are first faced, track loosened, butted together, and a new joint made. No non-revenue producing service of cars required. There are no delays in train movements as the job is done between runs.

Any amount from 3/10 inches up can be cut from a rail. Cutting time ranges from 5 to 10 minutes depending upon the size and hardness of the rail. The RACINE way of rail cropping is the safest for cutting is done cold, and no hardening or heating of the rail develops that would change grain structure.

Write today for full particulars . . . also for our new catalog No. 58-A.

RACINE TOOL & MACHINE CO.
1738 STATE ST. ··· RACINE, WIS.

FOR LOWER COSTS

on Reconditioning Crossings and Frogs

...use these time-proved AIRCO methods

Worn Frogs and battered rail ends are quickly reconditioned with the Airco Oxyacetylene Process — then heat-treated with the same torch for longer life. These operations may be done either in the shop as illustrated, or, on the road if desired. They are but two of the many ways in which the Airco Oxyacetylene Flame is cutting maintenance costs from coast to coast. » » » The practical experience and advice of the members of our Applied Engineering Department is at the service of Airco's railroad customers for problems such as rail end cropping, building up rail ends, hard surfacing, flame cutting locomotive and car parts, or in any other service in which Airco methods can be of assistance to you.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS

MAGNOLIA-AIRCO GAS PRODUCTS CO.

General Offices: HOUSTON, TEXAS

OFFICES IN ALL PRINCIPAL CITIES

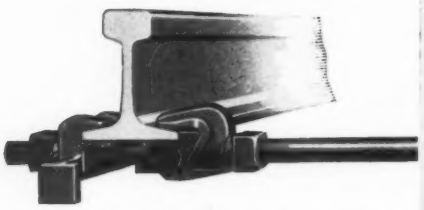
AIRCO

WILSON

OXYGEN IS PRODUCTION — *Don't Waste it!*

A FAST, DEPENDABLE SOURCE FOR RAILROAD ACCESSORIES

ALL FOR VICTORY
OLIVER



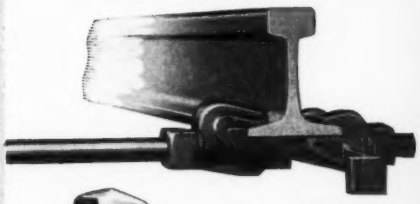
GAGE RODS. A complete line of insulated and non-insulated gage rods for main line, yard and industrial tracks reduce maintenance, assure greater safety.

TRACK BOLTS. Oliver Track Bolts include special switch, frog and crossing bolts as well as regular and Dardlet Track Bolts of various types and sizes. Shown above are representative items from the complete Oliver line. Extra toughness to pull-up tight, resist shear and tension. Accurately made for good fit, quick assembly.

Other Oliver Track Fasteners and Accessories Include:

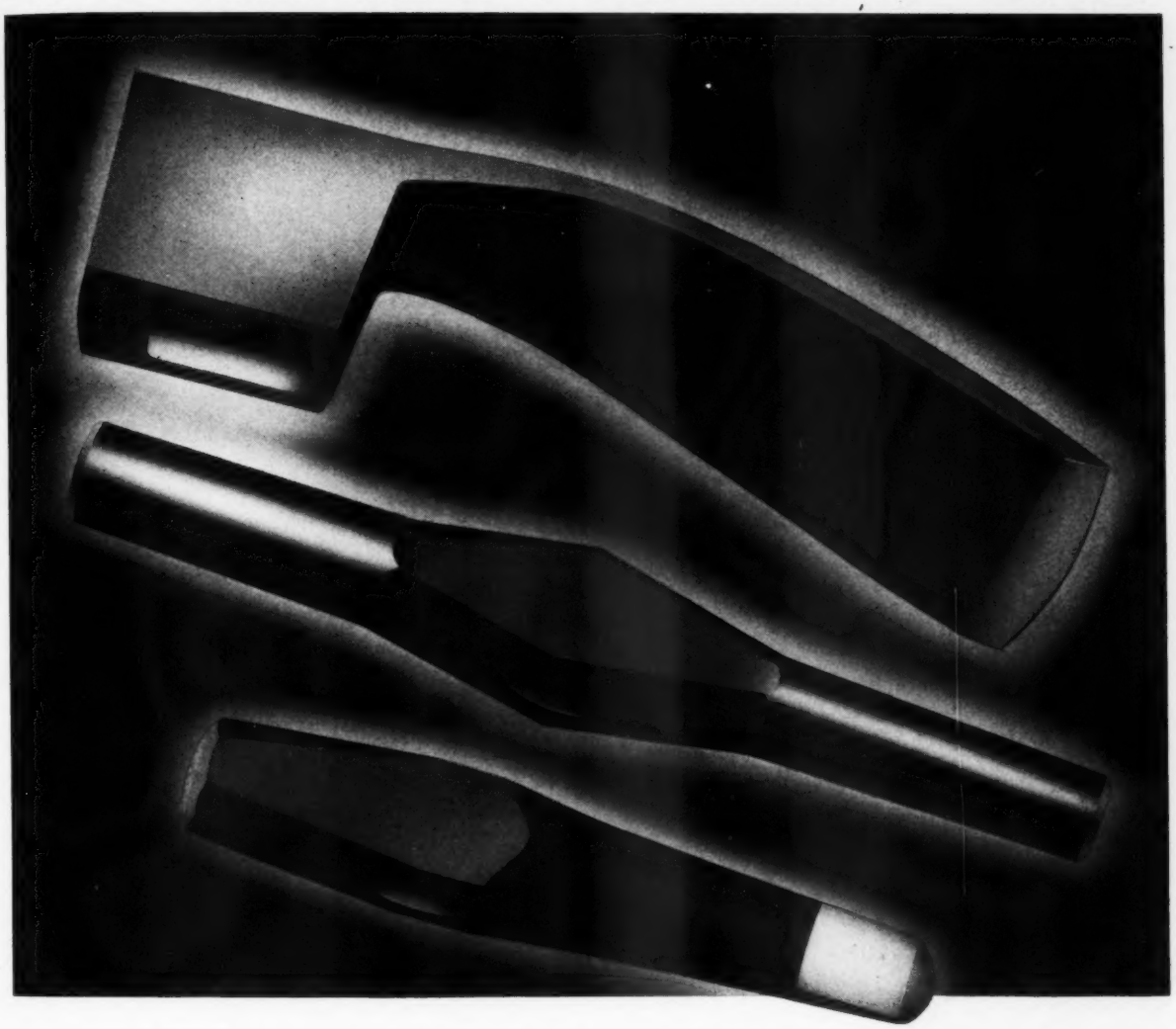
- T-HEAD CLAMP BOLTS
- RAIL BRACE BOLTS
- RAIL CLIPS
- RAIL CLIP BOLTS
- HEEL BLOCK LONG LENGTH CUT THREAD TRACK BOLTS
- STANDARD AND SPECIAL BOLTS, NUTS AND RIVETS OF ALL SIZES AND TYPES

OLIVER
IRON AND STEEL
Corporation
PITTSBURGH, PENNA.



SCREW AND DRIVE SPIKES. Through broad experience in the railroad field, Oliver has developed a line of sturdy, dependable screw and drive spikes that drive fast, grip solidly, prevent shifting of tie plates, extend tie life. Shown above are two types of screw spikes and, right, a Hold-Down Drive Spike.

FOR THE COMMON INTEREST OF YOUR COUNTRY AND YOUR ROAD



USE ALLOY HAND TOOLS WHICH LAST LONGER

Conservation of steel is vital. Hence, the tools you purchase now must last longer. This results in much needed and important savings for your country as well as yourself.

The Devil Line of heavy hand tools is made of electric furnace alloy steel which not only permits longer tool life, but also reduces accidents caused by chipping and spalling.

By putting the Devil Line in the hands of your gangs, you will make fewer tool replacements, thus conserving considerable steel tonnage. Your cost and safety records will surprise you. DEVIL ALLOY TOOLS ARE STILL AVAILABLE FOR YOUR ROAD TO KEEP YOUR STOCK ROLLING FASTER AND FASTER OVER GOOD RIGHT-OF-WAYS.

Devil Tools
ELECTRIC FURNACE
ALLOY STEEL

SERVING OUR COUNTRY'S BEST INTERESTS BY SERVING YOU

By having alloy tools available for railroads now, Warren Tool Corporation realizes that it is only fulfilling an obligation to its old customers which are conquering difficult and gigantic problems. In addition, Warren Tool Corporation joins them in doing direct war work in order to bring this conflict to a rapid as well as permanent victory and peace.

WARREN TOOL CORPORATION • WARREN, OHIO

Picture of a Man Fighting Hitler

Every man that helps to keep the railroads going smoothly — so that troops, munitions and supplies can roll — is greasing the skids for Hitler.

Here is a man that's doing it the best, fastest and easiest way possible. He's making repairs with electric tools *operated by a Homelite Portable Generator.* And you can multiply this man by the thousands. For all over the country, a vast number of Homelite Gasoline-Engine-Driven Generators are furnishing section gangs with the electric power necessary to operate tools that speed maintenance and eliminate delays.

If you are one of those who use Homelite Portable Generators, send for our free service manuals that show how to keep your units in good condition. Specify the model and serial numbers of your units with your request.

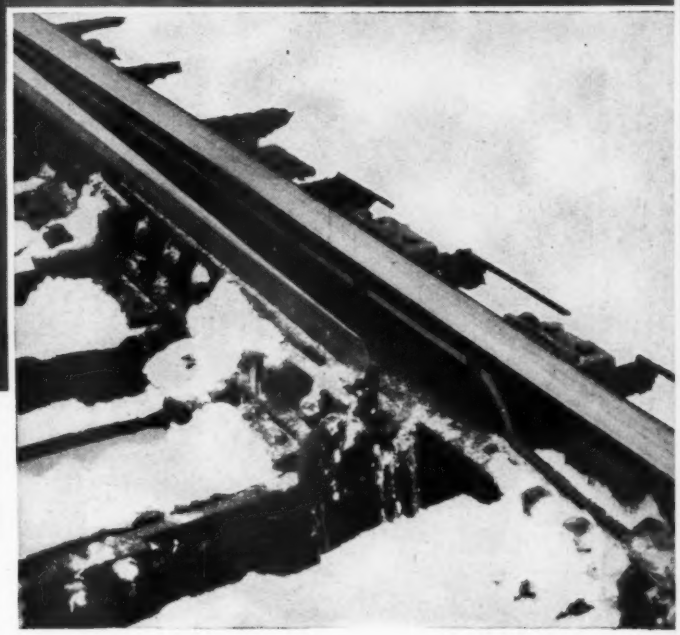
Homelite Generators are used to operate floodlights on night work as well as for electric tools. There's enough power in a Homelite to do both jobs well.

Homelite Corporation

2110 RIVERDALE AVENUE . . . PORT CHESTER, NEW YORK . . . U. S. A.

WINTER WON'T WIN A ROUND

. . . against switches equipped with ELECTRIC SNOW MELTERS



On the Pennsylvania, G-E snow melters have reduced delays, cut costs, and promoted safety

THIS winter, when you will be moving more traffic than ever before, G-E Calrod electric snow melters can do a lot to help you move it faster, more safely, and at less cost.

On the Pennsylvania, for example, many installations of G-E snow melters are doing just these things—and to be specific about cost—for about 2 kw-hr per hour per 18-ft point.

Electric snow melters are ready to go to work the instant snow begins to fall, and they'll keep your switches open even under the severest conditions. You don't have to supervise them or watch them—they can't get hurt.

G-E snow melters have the famous Calrod heating unit construction. Sealed in metal, the heating unit is dependable and long-lived. This means less maintenance and more certainty your traffic will get through on time. Get in touch with your G-E representative now—before the snows come and trouble and expense begin. A small investment now in G-E Calrod snow melters will pay you dividends for years on end. What's more, you'll be taking one more step to speed defense by speeding goods in transit. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

General Electric, Section D127-4
Schenectady, N. Y.

Without obligation on my part, send Bulletin GEA-2719. I should like complete information on G-E Calrod snow melters.

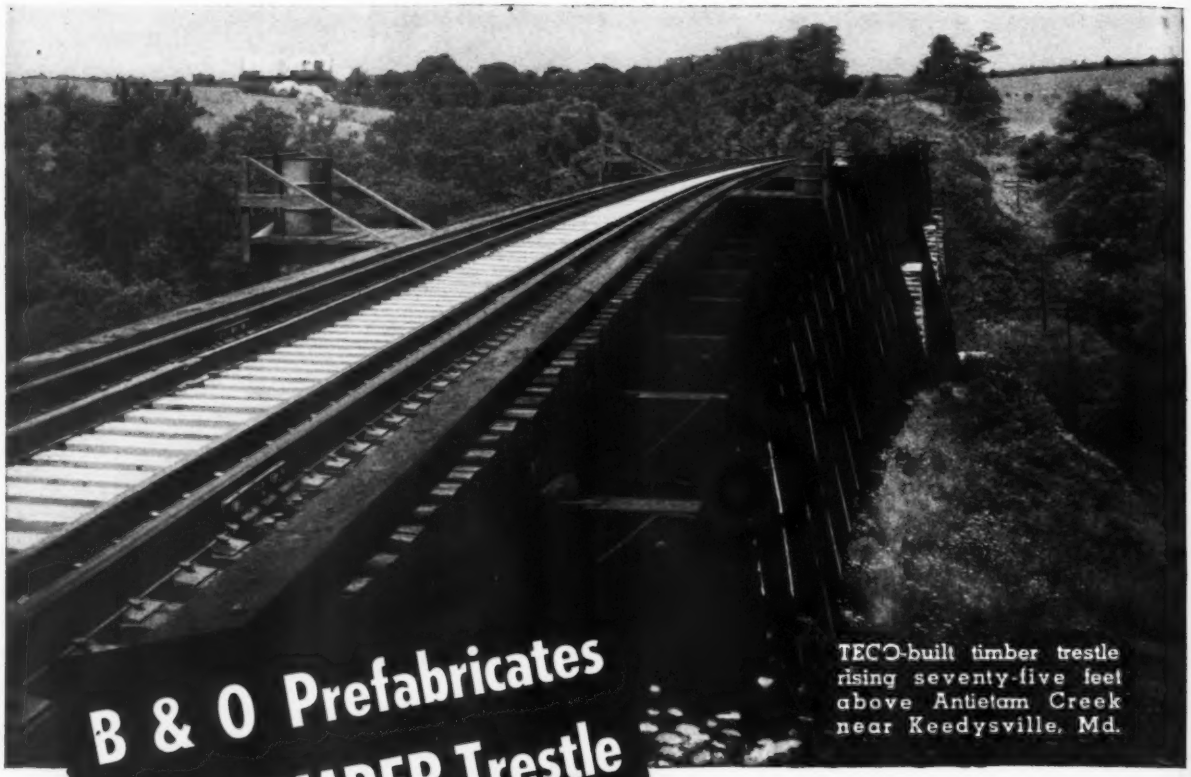
Name .....

Company .....

Address .....

City ..... *State* .....

127-4-176



TECO-built timber trestle rising seventy-five feet above Antietam Creek near Keedysville, Md.

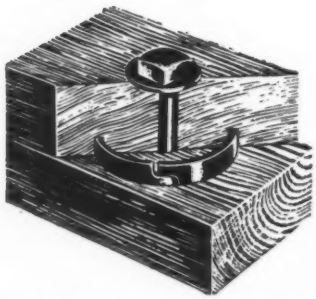
B & O Prefabricates Huge TIMBER Trestle

Railroad's own mill uses TECO Connector System to produce structural members for Antietam Creek Bridge

Reconstructing this bridge trestle to support main-line equipment, B. & O. produced one of the largest jobs of timber prefabrication it yet has undertaken. TECO Split Ring Connectors were employed throughout to augment the strength of stress-bearing joints.

Use of TECO Connectors did away with most of the bolts, plates, and angles formerly specified in heavy timber construction. Assembly of members was simplified. Steel, wood, time, and money were saved.

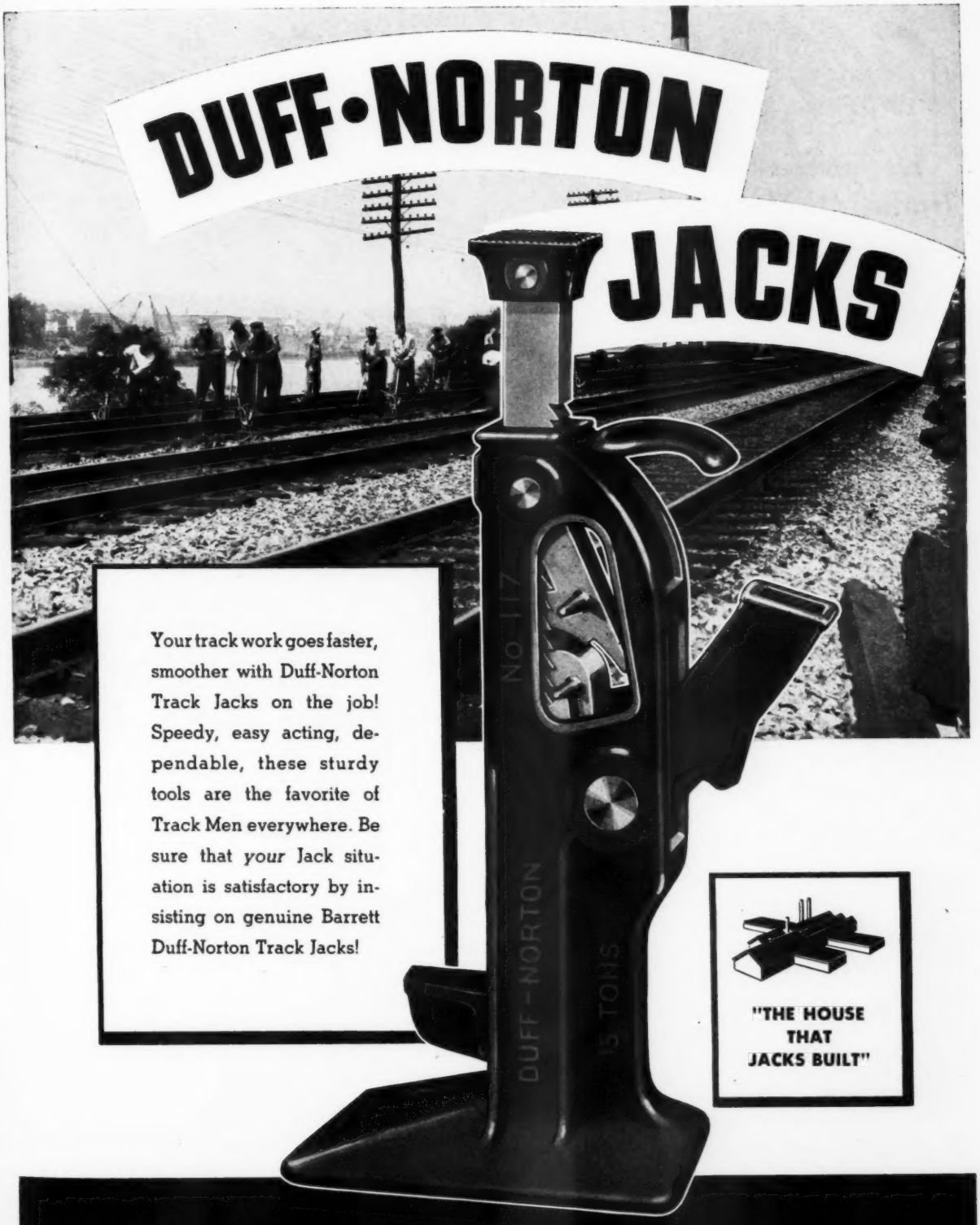
This installation is a striking example of how timber, engineered under the TECO Connector System, can serve the railroads. *Write for details!*



The TECO Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.

Timber ENGINEERING COMPANY
WASHINGTON, D. C. PORTLAND, ORE.

DUFF·NORTON JACKS



Your track work goes faster, smoother with Duff-Norton Track Jacks on the job! Speedy, easy acting, dependable, these sturdy tools are the favorite of Track Men everywhere. Be sure that *your* Jack situation is satisfactory by insisting on genuine Barrett Duff-Norton Track Jacks!

"THE HOUSE THAT JACKS BUILT"

THE DUFF-NORTON MANUFACTURING CO.
PITTSBURGH, PA.

Canadian Plant:
COATICOOK, QUEBEC

Representatives in Principal Cities

All clear . . . all times

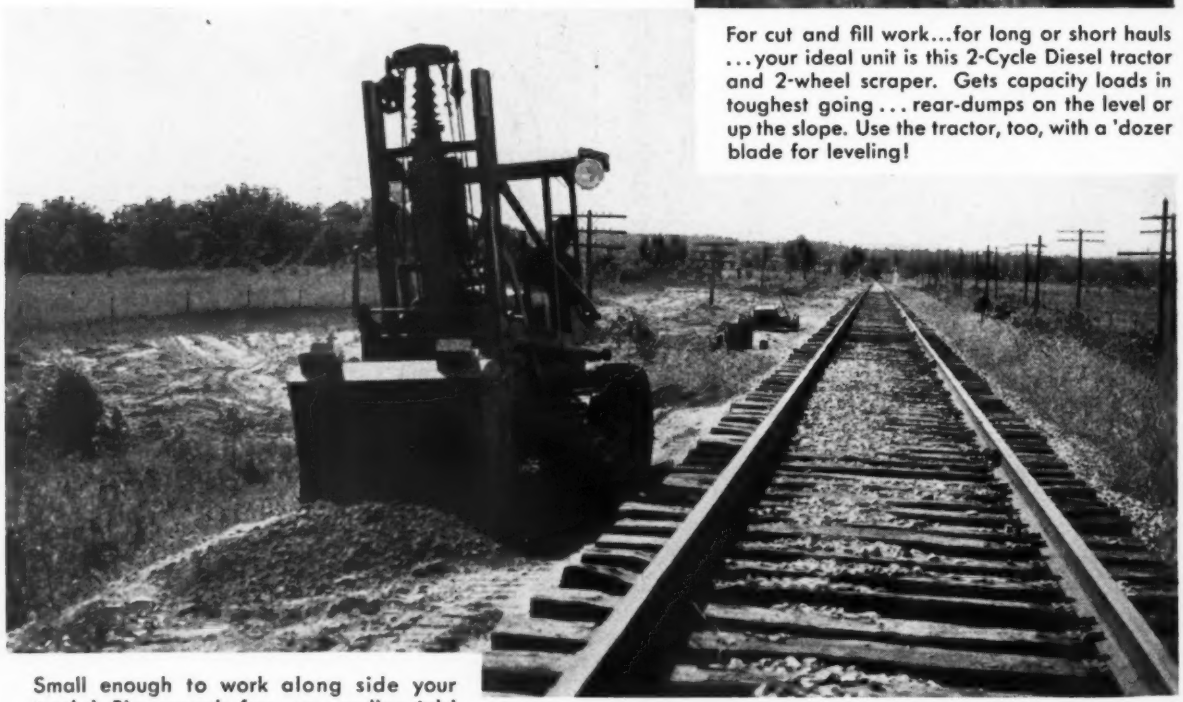
No Interference with Traffic with These Grading and Maintenance Units

You flash the "Go Ahead" signal with any of these "off-the-track" units handling your grading and maintenance work. No more traffic tie-ups, no more costly delays, no danger of accidents either! Each outfit does its work clear of the tracks . . . quickly, safely, at less cost. The result is improved service and faster, safer handling of your war-time traffic.

If you lack the priority to obtain a new outfit, see if your Allis-Chalmers dealer can furnish you with a good used unit. Even if he doesn't have one on hand, he may know where he can get it. As a clearing center, he runs across many good buys. Keep in touch with him. Use his A-1 equipment service, too. He has the right tools, skill and facilities to quickly turn out the highest grade work. See him . . . NOW.

Widen your ditches, build up your shoulders, root out stumps and trees, get rid of big boulders, with this 2-Cycle Diesel tractor and bulldozer. Pull your graders, too! Powerful, hard-hitting, 2-cycle engine enables you to handle the toughest work with ease. Throttle control means less gear shifting . . . more work done!

For cut and fill work...for long or short hauls . . . your ideal unit is this 2-Cycle Diesel tractor and 2-wheel scraper. Gets capacity loads in toughest going . . . rear-dumps on the level or up the slope. Use the tractor, too, with a 'dozer blade for leveling!



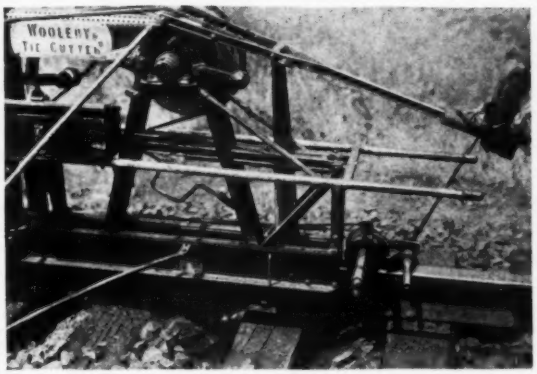
Small enough to work along side your tracks! Big enough for any grading job! This tractor-shovel digs, carries, dumps and spreads...cleans ditches, widens shoulders, loads ballast into trucks, handles a multitude of jobs.

ALLIS-CHALMERS

TRACTOR DIVISION · MILWAUKEE · U. S. A.

2 WAYS *to do* MORE *work with* FEWER *men*

WOOLERY TIE CUTTERS



Compactly built, the Woolery Tie Cutter can be operated on the track and moved on or off track by one man.

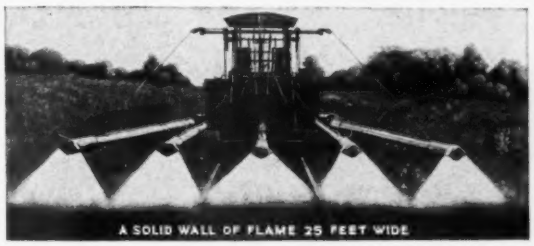
The Railroads are carrying a record traffic and tie replacements must, of necessity, be sandwiched in between trains.

To accomplish this feat, railroads are using Woolery Tie Cutters, singly and in fleets . . . they like their dependability, the quick, efficient manner in which the machine cuts the tie into three easily-removable pieces and eliminates the labor of pulling and digging out ties. Woolery Tie Cutters leave the tiebed practically undisturbed, permitting the new tie to be installed without trenching and with very little tamping.

By including Woolery Tie Cutters in your 1943 Budget, you can assure yourself of handling your next year's tie-renewal program in less time and with smaller track gangs, enabling you to direct the labor that will thus be released to other important tasks.

The Woolery Tie Cutter works equally well in stone, gravel or in any other type of ballast.

WOOLERY WEED BURNERS



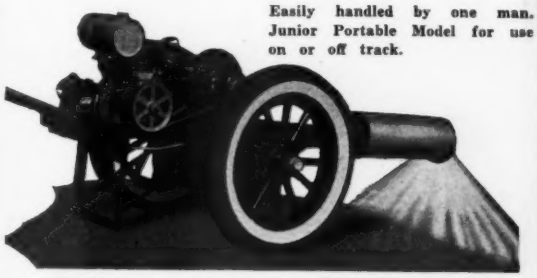
Above: 5-burner Giant Octopus Model; 3-and 2-burner Models also available.

To handle successfully today's unprecedentedly heavy traffic, tracks must be kept free of weeds and their harmful effects. With Woolery Weed Burners one or two men can remove weeds quickly, thoroughly and economically.

The fact that more than sixty railroads are now using Woolery Weed Burners is proof of their satisfactory performance.

If you are not already using one or more of these machines, select the proper Woolery models to fit your needs and . . . include them in your 1943 Budget.

Easily handled by one man. Junior Portable Model for use on or off track.



WOOLERY MACHINE CO.

Minneapolis Minnesota

Pioneer Manufacturers of

RAILWAY MAINTENANCE EQUIPMENT

Tie Cutters Switch Heaters Motor Cars
Railway Weed Burners Bolt Tighteners

No. 166 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: You Like Our Changes

October 1, 1942

Dear Reader:

"The July issue of Railway Engineering and Maintenance made a great impression on me and also on the employees of our engineering department. The changes made in the type face and other items make it a most attractive publication, and it is very easy to read, especially when this is done while traveling on trains.

"The needs of the present critical situation are brought out effectively, and the articles will be of great help in meeting them. The railroads are a great help in our war effort and it is evident that trains cannot operate unless bridges and buildings are kept in first-class condition. To bring this about, each employee must plan to co-operate with others. The information that you and your assistants furnish is greatly appreciated."

The above quotation from a letter which was received from a discerning administrative maintenance officer who has been a long time reader is self-explanatory. It supplements other letters which we have received, extracts from several of which were published in the August issue, commending the changes that we made in typography and the intensification of editorial objectives that we initiated in our July issue.

We have been greatly pleased with the tenor of these letters and of other comments that have come to our attention, because they indicate that our thinking coincides with that of so many of you and that you are finding the information that we are bringing to your attention especially helpful to you in these strenuous days through which we are all passing. And your commendation puts us under further responsibility to so edit Railway Engineering and Maintenance as to merit your continued approval.

Yours sincerely,

Elmer T. Howson

ETH:WB

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Lightest weight
Most accurate
Most dependable
Fastest

Raco Power Track Machine

Its Micro Cut-out sets the Raco Bolting Machine **apart,**—enables it to apply an **exactly equal** power to each nut.

Built of alloy steels, it combines **light weight** with **great strength,** which means **fast operation,** fewer delays, and fewer men required to lift it off the rail.

The larger roads tighten from **600 to 900 joints per day** with the Raco. Savings over hand tightening amount to **$2,000** per machine per year,—**plus** a far better and more uniform job.

Of course the Raco is specified by practically all roads.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE
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Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D.C.
1081 National Press Bldg.

SEATTLE
1038 Henry Bldg.

SAN FRANCISCO
300 Montgomery St.

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Subscription price in the United States and Possessions and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3, 2 years $5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

PRINTED IN U.S.A.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

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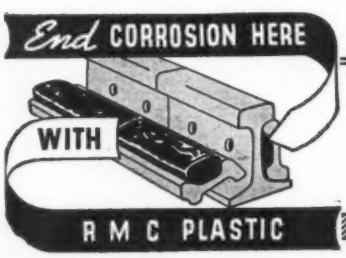

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Railway Engineering and Maintenance

War-Time Traffic—

Maintenance Forces Meet the Challenge

In the first six months of this year the railways spent $349,986,991 for the maintenance of their roadway and structures. This was an increase of $86,301,554, or 33 per cent, over the expenditure in the corresponding period last year and of $117,343,709, or 50 per cent, over the amount spent in the first half of 1940. It has not been exceeded since 1930 and present indications are that the total for the calendar year will exceed that for 1930. This is the answer that the railways and their maintenance of way forces are making to the country's call for adequate, dependable railway service in its time of national emergency.

In Spite of Difficulties

This high rate of activity is noteworthy because of the difficulty that maintenance forces are encountering in securing many materials. It reflects in part the drain on reserve stocks on hand; it is due to a greater degree to ingenuity in substituting other possibly less satisfactory but nevertheless serviceable materials. It is being made possible, so far as work equipment is concerned, by working these machines overtime or double shifts. And the difficulties in securing labor are equally as acute as those with regard to materials in many areas. These difficulties are being met by working forces longer hours (and increasing their earnings correspondingly to meet the competition of other industries) ; by developing new sources of supply; by providing more attractive housing facilities for floating gangs, etc. All in all, the volume of work being done reflects great credit on the versatility and determination of maintenance forces in overcoming obstacles.

Winning this war is the primary objective of every American. The efficient functioning of the railways is vital to our war effort. No railway service is more efficient or more dependable than its tracks and structures. It is for this reason that the remarkable response of railway maintenance forces constitutes such a great contribution to our war effort.

The tracks and structures of the railways have seen lean years of late. For a full decade, they were forced to draw on the surplus strength that had been built into them during the prosperous years of the late "twenties." These expenditures stood them in good stead during the depression years that followed; without them, the tracks and structures could not have carried the still more exacting, even though lighter, traffic that was thrust upon them. The retrenchment of the "thirties" took a heavy toll of the fixed properties. The quickness with which the railways have taken advantage of the increased earnings to restore their roadway and structures constitutes a refutation of the position that has been maintained in some quarters that the depression brought "no undermaintenance."

Will Meet the Problems

Maintenance forces have passed through difficult days. They are facing still more difficult days. They met the critical problems of the depression in a manner that won widespread commendation. They are now meeting the problems of maintaining their tracks and structures to carry the heaviest traffic in the history of the railways, in the face of inadequate supplies of both materials and labor, with the same versatility. The challenge of the railways, of their patrons, and this time of our armed forces also, goes to them. They accept it.

Building Forces—

Must Find Many Substitutes for Needs

THOSE building men who six or eight months ago felt that their activities would be little affected by the war have since received a rude awakening. At that time, it was the track forces who were already feeling the pinch, and while most building men saw the handwriting on the wall as regards structural steel and certain building plumbing fixtures and hardware employing the more critical non-ferrous materials, it was difficult for most of them to conceive that their relatively small requirements for many other materials would be cut off, or could not be taken care of by readily available suitable substitutes.

Since that time, now aware to building men generally, new home construction, except for war workers, has been brought to a standstill, modernization and repair operations have been seriously restricted where they involve new materials, freeze orders have been issued covering a wide range of construction lumber, and priorities or scarcity are affecting the procurement of many other materials.

Some railway building men have accepted the increased problems confronting their operations as an excuse for limiting their work to only the most essential repairs, even though non-critical materials alone are involved. Some, mistakenly, have even adopted the attitude that it is unpatriotic to carry out their normal repair programs, essential though they may be to adequate war-time railway service in the days ahead. On the other hand, and fortunately so, the majority of those in charge of railway building construction and maintenance have accepted the challenge of the increasing number of restrictions, and, through the ingenious use of non-critical substitutes and reclaimed materials, are carrying forward their building maintenance programs energetically, realizing that to do otherwise is to jeopardize the war effort rather than aid it.

Evidence in this latter regard is seen in the fact that to date in the present year many roads have maintained a normal volume of building work, while at least a few have found ways and means of increasing their normal programs. To do this in most cases has called for a re-orientation of thought in building design and construction—a reverting back to mill, frame and mass masonry construction—and, of greatest importance, the careful searching out and re-use of serviceable second-hand materials.

That there are almost unbelievable possibilities for carrying out essential building repair work through the use of second-hand materials is seen in the fact that one road is now completing the repair or remodeling of more than 80 buildings of various types, largely through the use of materials released from buildings abandoned and dismantled. Another road is now working on a plan calling for the abandonment and dismantling of about 100 no longer needed or little used passenger stations, to be replaced where necessary with small frame shelters of attractive design. From these stations to be abandoned, it has in sight a store of usable second-hand materials, fixtures and hardware that will go far to meet its building repair requirements for many months ahead. This same road is also making extensive use of re-worked salvaged box car lining lumber (2 in. by 6 in. tongue-and-groove), for roof sheeting, siding, rafters and studs, and another road has already completed 10 much-needed yard and shop buildings almost entirely of sheets released from dismantled steel box cars.

No one yet knows the extent of the problems to be faced by railway building forces in the future, but it is clearly evident that the magnitude of these problems will be in inverse ratio to the ingenuity that is employed by these forces in overcoming the obstacles that are presented. It is with little merit that some building men say that it cannot be done, while others are finding ways of doing it.

Labor—

Overcome Shortage with Machines

EVERYWHERE, on the farm, in the office, in stores, in industry generally and on the railways, the average age of those engaged in productive pursuits is higher today than it was last year, and it will be still higher next year, as more men respond for military duty. In some occupations, women are filling the jobs vacated by men who are leaving for service, but this is not so in the railway maintenance forces, because they work under conditions greatly different from those existing in offices, factories and stores. In fact, because of the nature of the tasks and the conditions under which the work must be done, there are relatively few jobs here that can be filled by women. Furthermore, to be performed adequately, many maintenance jobs require skill that can be acquired only after years of experience.

The railways have never been able to compete with industry for either skilled or unskilled labor when industry needs labor, because it cannot pay the wages that industry can and still remain solvent. For this reason, in addition to the drain imposed by military demands, the maintenance forces have been depleted still further by a widespread gravitation of competent labor to war-time industries.

As a result, a shortage of labor is developing, which is likely to become worse, with only an inadequate supply to draw from, consisting mainly of men who have no training in maintenance tasks and no background of maintenance requirements to aid them. In this situation, even with the best and most honest intentions, the output per man-hour can be expected to be less than that of the trained employee who expends no more, and perhaps less, effort in doing his work.

It is obvious that, with fewer men, most of whom are past their most active years, and with others who lack training, some expedient other than the effort to recruit more men will be necessary to insure that tracks and other facilities will be maintained to the standard necessary for a continuance of the operating efficiency the railways have demonstrated so far. Fortunately, maintenance officers have at hand a means for maintaining the productive capacity of their forces, in the large number of units of work equipment they

already possess and in the many other power machines and tools that are still available to them, as manufacturers have revised their designs to minimize the use of critical materials.

However, despite the number of machines in service and the large number that are being purchased currently, some roads are finding it difficult to meet all of the demands for the high standard of maintenance that has become necessary by reason of the volume and speed of traffic. In this situation, a more intensive use of the equipment available offers an additional solution of the bothersome problem of production, so that a further expedient, that of double shifts or longer hours for the working day, is open to those who desire to get the most constructive results with the means that are still available to them.

Railroad Scrap—

Now a Critical War-Time Need

FEW appeals have been made to the railroads of the country that are more urgent than that for scrap metal. Through the press, the radio, the mails and personal contacts, the government, and the American Industries Salvage committee, an organization sponsored and supported by industry itself, every one in the country, and especially the railways, is being urged to search out and turn in every available pound of scrap metal. Supplementing these efforts, the larger steelmakers of the country, including the United States Steel Corporation and the Bethlehem Steel Company, are spending thousands of dollars in advertising to stimulate the flow of scrap to their mills, in order that essential war production shall not be curtailed. These advertisements stress the fact that the steel mills need scrap *now*, and especially railroad scrap.

Railway Engineering and Maintenance has already put its shoulder to this essential drive, pointing out in the editorial pages of its August issue, under the head, Scrap—A Pressing War-Time Need, that the shortage of this material threatens to limit our production of steel; that collections have been running far short of the requirements of our war effort; and urging maintenance men to still greater alertness in searching out and turning in every bit of unserviceable metal on the right of way, "even to the spike stubs left in the ashes when old ties are burned." In the same issue was presented a detailed story of the outstanding job that has been done, and which continues to be done, on one railway in combing its property for scrap and salvageable materials.

Stimulated by these and other efforts to state the need and to point out how the problem must be undertaken and followed up, it is certain that every railroad in the country has entered the national scrap drive aggressively. In spite of this, we make no apologies for this further appeal for still greater effort. If scrap was a pressing need two or three months ago, it is a critical need now.

The appeal is made with greatest emphasis to the railroads, not alone because they are one of the largest normal sources of scrap, but because, as pointed out by one of the steel companies, so much railroad scrap comes in heavy pieces—which means less work to prepare it, and thus speeds up production. The appeal within the railroads is with greatest force to those in the maintenance of way department, because this department is normally the source of more than half of the railway scrap. This appeal presents a challenge to every maintenance man—not for a day, a week, or a month—but for the duration. Is there a maintenance man who will not accept this challenge whole-heartedly?

Conventions—

In Time of War

IN arriving at their decisions to proceed with their annual meetings, the officers of the Roadmasters' and Maintenance of Way Association and of the American Railway Bridge and Building Association acted with a full appreciation of the seriousness of the days through which the railways and their maintenance forces are passing. In fact, it was this realization and their knowledge of the intensity of the problems that are confronting those maintenance officers who comprise their members that prompted them to proceed with plans for meetings that would bring to these members information that would help them face and solve the critical problems of these days.

In reaching this decision they took the courageous but difficult course. To have abandoned their meetings, as many other associations have done, would have been the easy course. To proceed required courage to face possible criticism and misunderstanding of motive. But they went ahead on the premise that if their associations had been justified as meeting needs of their members in the more normal years of the past, the opportunity for service to these members is immeasurably increased in these days when the problems confronting them are so intensified and the necessity for results is so greatly increased.

The challenge, as they saw it, was to meet these new and vastly more serious problems with programs built to reveal the full measure of these problems and to point to their solution, and by so doing to render increased service to those attending the meetings and to the roads from which they come. The intensely timely and practical character of the program presented at the Roadmasters' meeting on September 15-17 affords ample evidence of the justification of that meeting. And the participation in this program of men holding large responsibilities in the War Production Board, the Office of Defense Transportation, the Association of American Railroads and individual railways shows their appreciation of the need for such a meeting and their desire to co-operate in the development of answers to today's puzzling questions. An equally constructive program is to be presented at the meeting of the Bridge and Building Association the third week in October.

The officers of these associations are to be commended for their willingness to undertake difficult assignments. They have recognized and accepted responsibilities to their members and to the railways that are consistent with the records of these organizations through the half-century during which both of these associations have functioned.

Denver & Salt Lake Through Long-Time

Left—A Typical Timber Portal of One of the Many Timber-Lined Tunnels on the D. & S. L.

Below — Showing How Track and Bridge Jacks Were Used to Unburden a Length of Old Timber Sill So That It Could Be Removed and Replaced With Concrete

Right — Within One of the Tunnels, Showing How the Sill Work Was Carried Out on Both Sides. Concrete Is in Place Along the Left Side Wall

CONFRONTED with increasing maintenance of the timber lining in its many tunnels in order to insure safe and unrestricted train operation, the Denver & Salt Lake has undertaken a long-time program of "spot" lining renewal with concrete, attacking the worst conditions first, progressively, while eking out the maximum service life from the remaining timber before replacing it. In fact, to this latter end, it is relining the entire perimeter of specific sections each year only where decay of the timber "sets" generally, encroachment on track clearances or other circumstances demand, confining the major part of its work thus far to the replacement of decayed sills and bases of wall posts, with the aim of replacing the remaining timber with concrete only as its subsequent condition may require. Through this procedure, which is being carried out without interference with traffic, the road is not only capitalizing to the greatest extent on the life still remaining in its present linings and deferring renewal costs as long as possible, but, through the methods employed in carrying out the work, is installing the new concrete at a cost that is little, if any, more than would be required to maintain the existing timber lining by repairs, strengthening and replacements.

11,490 Ft. of Timber Lining

The Moffat line, as the D. & S. L. is called, is a mountain road throughout practically its entire length of 232 miles, much of it being at high altitude, facts which have an important bearing upon the number and length of its tunnels and upon the life and necessary maintenance of their timber linings. From its eastern terminus at Denver, Colo., at Elev. 5,170, the line begins almost immediately a winding ascent of the eastern slope of the Rocky mountains, passing through the Continental divide in the Moffat tunnel, 50 miles from Denver, at a maximum elevation of 9,238 ft., and thence extending generally west and northwest to Craig, Colo., 182 miles distant, at Elev. 6,175.

The tunnel-lining problem that confronts the D. & S. L. is seen in the fact that, exclusive of its Moffat tunnel, which is 32,798 ft., or 6.21 mi. long, it has a total of 23,838 lin. ft. of single-track tunnel in 51 other tunnels, about 11,490 lin. ft. of which are already lined with timber.

The Moffat tunnel, which was constructed in the years 1923-1928 to avoid the original steep climb of the road over the top of the Continental divide, is by far the most outstanding tunnel on the road, but, having been completely lined with concrete in the years 1933 to 1936, it does not enter

Seeks Greatest Security Tunnel Lining Program

With approximately 11,500 track feet of timber lining in 51 tunnels facing increasing maintenance and repair, the Denver & Salt Lake has adopted concrete for replacement work in a manner that secures maximum service from the existing timber, while insuring maximum safety of train operation. This article describes the program under way and the specific methods being employed

into the present problems of the road, and is not considered in this article.

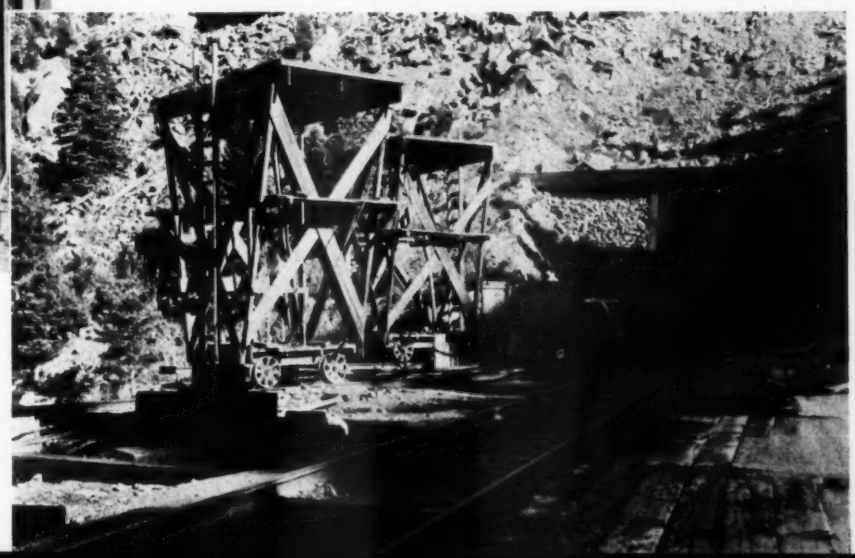
The other 51 tunnels on the road, with their 11,490 ft. of timber lining, are the present and future tunnel problem of the road, and will remain so until all of their timber linings have been replaced with concrete under the program now under way. Of these latter tunnels, which range in length from 62 ft. to 1,727 ft., with an average length of 467.4 ft., 27 are located on the 50 miles of line on the East slope of the mountains, east of the Moffat tunnel, while the remaining 24 are located on the remaining 182 miles of line west to Craig. In fact, indicating the greater prevalence of tunnels on the East slope, some of which are only a few hundred feet apart, is the fact that all of the 27 tunnels on this slope, with an aggregate length of 15,868 lin. ft., lie between Mile Posts 24 and 37, a distance of 13 miles.

Condition of Old Lining

The various tunnels on the line penetrate a wide range of rock and rock formations, including porphyritic granite, pre-cambrian sandstone, gneiss and talc. Some of these have required timbering, to prevent rock falls and to resist varying degrees of pressure, while others have required no lining or support. This has brought about a situation where the extent of the lining in the different tunnels varies widely, from none in 7, to continuous lining throughout in 19 others. One of the longer tunnels has six separate sections of lining, ranging in length from 41 ft. to 502 ft.

The lining in the different tunnels varies considerably in design, but, in general, consists of heavy timber sills, 12-in. by 12-in. timber posts, with spacing, depending upon the pressures encountered, 12-in. by 12-in. timber wall plates, and a five-segment timber arch constructed of timbers of the same size. Where required by the character of the rock, the timber sets are lagged with 3-in. plank and packed with stone or timber packing, and the underside of the arch, directly over the track, is faced with a tight-board spark arrester. All of the heavy timbers of the lining are of untreated Oregon fir, while the lagging and packing are of untreated native pine. The spark arrester is of redwood.

Two main factors entered into the inauguration of the present program of replacing the timber lining with concrete. One of these was the increasing cost of maintaining the old lining, much of which was put in during the construction of the line between 1903 and 1914, and the other was the restrictive clearances at many points in the lined areas. In general, the timber in the shorter tunnels has stood up well, which is attributed both to their high altitude and to the good ventilation that prevails in most of them. This situation cannot be said



Above—Adjustable Steel Forms, in 10-Ft. Sections, Were Used in the Lining Work. Right—Two of the Push-Car Mounted Tower Scaffolds Employed in the 1941 Work

to prevail to the same extent in the longer tunnels, and, furthermore, the sills and lower ends of the posts in both short and long tunnels, subject as they are to alternate wet and dry conditions, have become a source of increasing maintenance.

The New Lining

Clearances quite generally throughout the timbered sections are adequate for most traffic, in spite of the fact that they are generally below the present standards of the road, but at many points, due to settlement and various methods of strengthening the timbers, they are unduly restrictive. In not a few cases, due to these causes, side clearance has been reduced to as little as seven feet from the centerline of the track, and vertical clearance, to as little as 19½ ft. above top of rail. The present standards of the road call for a vertical clearance of 22 ft. to the underside of the crown of the lining, and, on tangent track, a lateral clearance of 8 ft. from the center line of track. On curves, which are as sharp as 12 deg. in some of the tunnels, the side clearance on the inside of the curves is increased one inch per degree increase in curvature.

Confronted with these conditions of restrictive clearances and of increasing timber maintenance, the D. & S. L., in the light of its favorable experience in the lining of its Moffat tunnel, adopted concrete lining for the replacement, as required, of the existing timber lining in all of its other tunnels. At the same time, it set up a program and method of procedure to be followed in carrying out the work that contemplate realizing the maximum service life from all existing timber.

The lining section adopted provides for clearances in accordance with the present standards of the road, but the thickness of the walls and arch varies considerably with the conditions encountered, from a minimum of 6 in., without reinforcing, where not subjected to pressure and employed essentially as a protection against weathering, to a minimum of 18 to 20 in., reinforced with second-hand curved rails, placed on varying centers, where pressures are encountered. The footings, with a top elevation of 14 in. below the top of rail, are carried down as deep as necessary to secure a firm foundation, but in no case less than 18 in.

The rails that are used as reinforcing are of 80-lb. scrap section, recovered from annual relay requirements. These are pre-curved, with the base inward, at the road's shops at Utah Junction, Colo., and, when set in place, are bolted together at the crown of the arch with sections cut from scrap angle bars. In all cases, the rails are curved to permit standard clearance with a minimum cover of three inches of concrete on the underside or inside perimeter of the lining. The rail sets are spaced from 12 in. to 60 in. center to center, depending upon conditions, and adjacent sets are tied together horizontally by means of a series of six ⅜-in. stud bolts, extending from web to web.

In addition to acting as reinforcing for the concrete, the rail sets are made to carry the load temporarily by stulling therefrom when the old timber sets are removed. Where adequate thickness of concrete can be secured without disturbing the old timber lagging, this is done, except at the haunches and footings, where all lagging and packing are removed. In fact, in cases where the rock lies more than 20 in. back from the face of the new lining, and no lagging exists, lagging is sometimes installed to avoid the use of an unnecessarily large amount of concrete.

Installing Sills

In the actual lining replacement work, the D. & S. L. has put in sections of the entire arch ring and footing at the same time, and will, undoubtedly, find occasion to do this again, but as a general rule it is now following a practice of installing the footings alone first, where needed, to overcome conditions of decay in the sills and the lower parts of posts, with the plan of coming back at a later date, when the condition of the remaining timber warrants, and installing the concrete lining itself. Through this procedure, it is not only securing the maximum normal life from the timber above the sill line, but estimates that by removing the decayed timber at the base, it will extend the life of the remaining timber by at least three years. Thus, while the road installed 391.5 track feet of full lining in four tunnels in 1940, and 268 feet of full lining in two tunnels in 1941, it installed 1447 track feet of footings alone in five tunnels in 1940, and 1222 track feet of footings alone in five tunnels in 1941.

In removing the old sills, working on one side at a time, the load is first taken off a length of the old sill by means of a series of track or bridge jacks angled into the individual posts or groups of posts, with the heads of the jacks butted against clusters of spikes driven into the posts, or against track angle bars spiked to the posts. The next operation is to cut off and remove the decayed bottoms of the wall timbers, usually from a few inches to as much as 18 in., depending upon conditions, using a power-driven chain-type saw, and then to dig out the exposed section of the old sill. When these operations have been completed, the trench for the new concrete footing is cleared out, forms are set up, and the new footing is poured.

The concrete for the footings is prepared in a ¾-yd. portable mixer, mounted on a push car. The materials for each charge are batched and placed in the mixer at a convenient point outside the tunnel, and the mixing proceeds while the mixer is being pushed into the tunnel. At the point of pouring, the concrete is chuted directly into place, and the mixer is then returned to the batching point for another charge. To clear for traffic, the mixer car is spurred off on a temporary construction track by means of portable switch point riser rails which carry the wheel flanges over the top of the main track rail.

After the concrete in a new section of footing has taken its initial set, the decayed ends of the posts removed are replaced with sound pieces of second-hand timber, which are secured in place by side board splices. Then, usually within 48 hr., the jacks are released and the load on each post is transferred to the new footing. All of this work is done without interfering with trains, and is itself interfered with only during the actual passage of trains.

Placing Full Lining

Where the concrete lining is to be placed immediately following the completion of the footing, the rail sets, if any, are erected in place prior to the pouring of the footing, and thus anchored firmly in it. Subsequently, the timber sets are removed, the rail sets are tied together horizontally, and the section involved is otherwise prepared for pouring the lining.

Wherever sections of new lining are installed, the natural rock is cut back as necessary on the sides and over the top to provide the thickness of lining and clearances called for, this work being done with a variety of hand and power tools as best suited to conditions. This work is generally carried out from two tower scaffolds mounted on push cars, which are readily moved into and out of the tunnel, and spurred off on a temporary construction track to clear for trains by means of the portable switch point riser rails referred to previously. Artificial illumination for all of the

tunnel work, where necessary, is provided by means of electric lights, powered by a portable generator set.

The placing of the concrete in the walls and arch, whether in conjunction with the footing work or at a later date, is done with the aid of 10-ft. sections of collapsible steel forms. These short form sections, cut from the 40-ft. forms employed earlier in the lining of the Moffat tunnel, are being used because, with the heavy curvature in many of the tunnels, a better lining face and increased economy in concrete can be secured.

The form sections to be used at any specific time are collapsed, or drawn inward, when being moved into or within a tunnel, and are expanded to full section at those points desired, the adjustable feature being afforded by a series of push-and-pull screw jacks at the top and bottom. Movement of a form section longitudinally is accomplished by means of dolly shoes bolted to its base, which are designed to operate on timber runways provided temporarily along the tunnel wall.

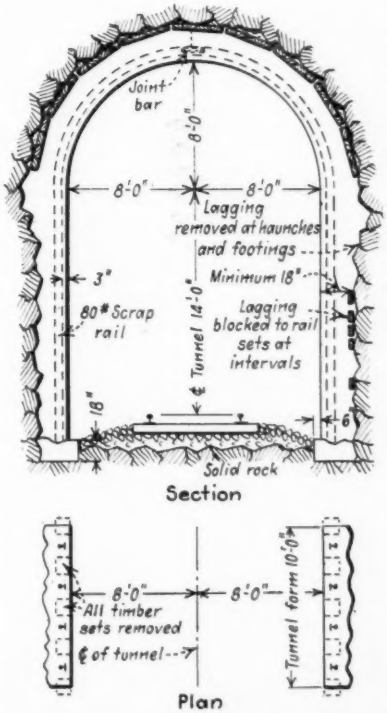
All of the concrete in the lining itself is placed by means of a Pumpcrete machine located at a convenient point outside the tunnel, usually within 200 ft. of the near portal. Here also are located the concrete mixer (of ¾-yd. capacity), the cement house and the aggregate piles. The water supply at the different points of operations has varied somewhat, but where water cannot be pumped directly to the mixer from creeks or other sources, it is pumped to two portable tanks moved about with the tunnel lining forces, one of 5,000-gal. capacity and the other of 1200-gal. capacity, which are located high enough, usually on a hillside, to permit gravity feed to the mixer.

From the Pumpcrete machine, which is operated by a 20-hp. motor, the concrete is transported to the forms through a 6-in. steel pipe line, which is extended along the ground level to the tunnel portal. At the portal, by means of a 22½-deg. ell, the line is carried upward to the spring line of the tunnel on one side, and thence extended horizontally along the wall to the forms. At the forms, the concrete line enters the bulkhead at the rear end, at the crown of the arch, where the concrete can be directed uniformly to both sides as the lining is built up.

The concrete placed in the lining above the footings includes special aggregates and a mix that has been found especially suited to placement by the Pumpcrete machine, while at the same time having an average slump of 7 in. and strength generally in excess of 4,000 lb. per sq. in. at 28 days. The mix embodies 1 part cement, 1.75 parts sand, 1.35 parts pea gravel, 2.17 parts coarse gravel, and 6 gal. of water. The sand employed is unusually fine and has a high aluminum content, but was selected specifically after considerable study and experimenting showed that it has the effect of lubricating the mix and facilitating its movement through the Pumpcrete line, without affecting the strength of the concrete.

Organization of Forces

The force employed on the tunnel lining work is varied somewhat with the character and extent of the work, but generally consists of a single 10-man gang where the footings alone are being replaced, and two 10-man gangs, with partially overlapping working hours, where the new lining as a whole is being installed. In the case of the footing work, the single 10-man gang does all operations, from the removal of the old timber sills to final blocking on the new concrete footings, the specific assignments of the men being varied to meet conditions. In the case of the full lining work, on the other hand, one gang, starting at 6 a.m., does most of the work preliminary to the actual concreting, while the other gang, coming on at 12:30 p.m., completes this work and carries on with such pouring as may have been started by the morning gang. Later, it closes up the work for the day and cleans the Pumpcrete machine and delivery line.



A Typical Tunnel Cross Section and Plan, on Tangent Track, Showing the Concrete Lining Standards Being Adhered to

While the hours of the two gangs overlap, which is generally from 12:30 to 2:30 p.m., the largest volume of concrete is placed, the 20-man force being assigned about as follows:

2 foremen
1 man operating the concrete mixer
1 man operating the Pumpcrete machine
3 men carrying cement to the mixer
1 man handling cement into the mixer
1 man attending to the water supply
6 men, with wheelbarrows, handling aggregates
3 carpenters
2 men doing miscellaneous work
2 men flagging

During the concreting work before or following the period in which the gangs are consolidated at the middle of the day, men in the 10-man gangs are usually assigned as follows:

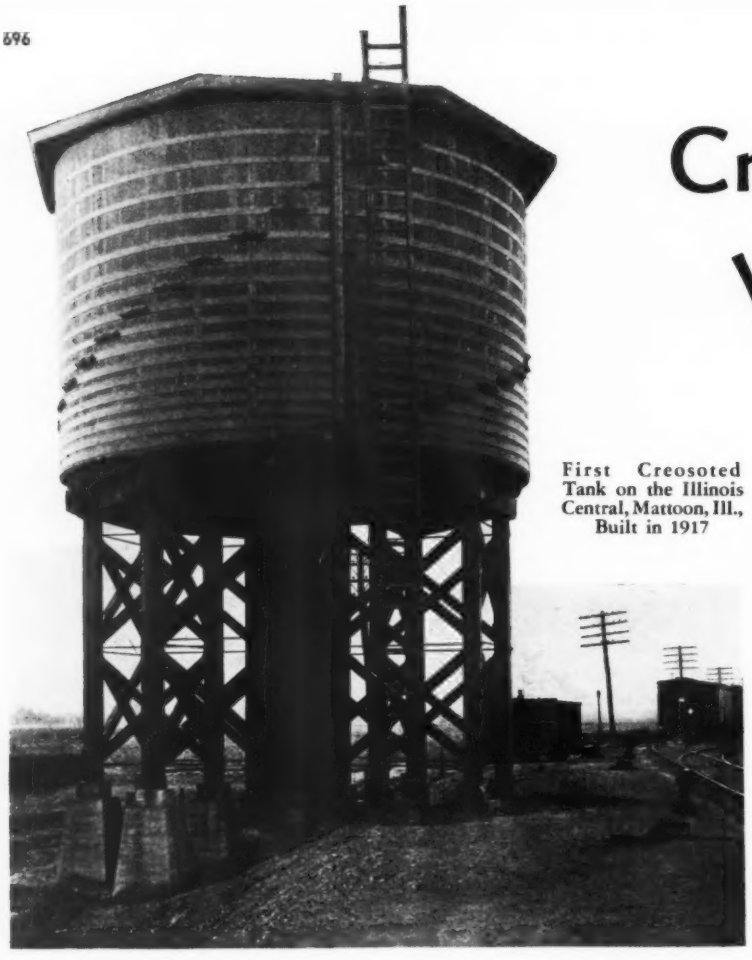
1 foreman
1 man operating the concrete mixer
1 man operating the Pumpcrete machine
1 man handling cement from a supply stacked at the mixer
1 man attending to the water supply
3 men handling aggregates
1 man with miscellaneous assignments
2 men flagging

Without interference by traffic, it is possible for one of the 10-man gangs to draw in the sides of one of the 10-ft. form sections from a finished section of lining, move it ahead and jack it out into position for the next pour, in approximately 35 minutes. To pour a complete section of the lining, with both gangs cooperating for a part of the period, requires approximately four hours.

To the end of May, 1942, the D. & S. L. had completed 1053 track feet of full lining and 2,793 track feet of footings in its long-time tunnel lining program, which it is expected may be extended over a period of 20 to 25 years in order to get the maximum service life from the existing lining timber. Depending upon the amount of rock excavation required, the extent of traffic interferences and other variable factors, the cost of the work thus far has varied considerably, that for the lining, above and independent of the footings, ranging from $80 to $145 per track foot, and that for the footings alone, from $8 to $12 per track foot.

All of the tunnel lining work described has been planned and is being carried out under the direction of W. C. Jones, chief engineer of the D. & S. L. Field operations have been under the direction of B. Schneitman, supervisor of bridges and buildings, and F. K. Calkins, until September 1, 1942, acting supervisor of bridges and buildings, and now division engineer.

Creosoted Water Tanks—



First Creosoted Tank on the Illinois Central, Mattoon, Ill., Built in 1917

GROWING out of a situation similar to that which confronts the railways today, but in much less acute form, the Illinois Central began twenty-five years ago to build creosoted wooden water tanks in place of steel tanks. These structures proved to be an immediate success, and the practice has been continued ever since, until today there are 164 such tanks on this road, including the first one erected in 1917.

For several years prior to the decision to erect tanks of creosoted material, the Illinois Central had been engaged in a system-wide program of water supply improvements. This included larger wayside storage tanks and the replacement of other tanks that were at or approaching the end of their service life. At this time the supply of timber suitable for railway water tank construction, especially those of large capacity, was becoming so scarce that it could be obtained only with difficulty. For this reason, beginning in 1911 and continuing until 1917, a considerable number of steel tanks had been erected and were beginning to be looked upon as standard.

As early as 1913 plans had been prepared for the construction of creosoted tanks, but authority for building them had been withheld, primarily in the fear that the creosote might contaminate the water and render it unfit for locomotive use. In 1917, a steel tank was planned to replace an old wooden tank at Mattoon, Ill. However, before the material for the new tank was obtained, the priority board prohibited the use of steel for constructing water tanks.

Tank Woods Scarce

Previous investigation had disclosed that, although many species of wood had been used without preservative treatment for tank construction, only a few were then available in the size, length and quality required for large tanks, and that when the probable life of the untreated timber was considered, the list was virtually reduced to cypress and redwood.

As the need for the new tank developed into the nature of an emergency, permission to go ahead was given somewhat reluctantly, although this reluctance was tempered somewhat by information that the Cleveland, Cincinnati, Chicago & St. Louis had erected a creosoted tank at Sidney, Ohio, as early as 1907, and that no difficulty had arisen by reason of contamination of the water by the creosote. However, only the tub was of creosoted material, the substructure or tower being of steel. On the other hand, the Illinois Central had been using creosoted timber for the tower members since 1904, so that from the beginning its tanks have included creosoted timber for the entire structure, from foundation to finial.

Loblolly pine was used in the first 18 or 20 tanks, and was purchased in accordance with the current specifications for tank timbers, except that the restrictions against sap were not enforced. In fact, an effort was made to get, as nearly as possible, all sapwood for the staves and one sap face for the bottom or floor planks. The result was that in these first tanks the staves were all sapwood, and no heartwood more than 1 in. thick was found in any floor plank. This timber was seasoned for three months under favorable dry-weather conditions, framed, and then given a Rueping treatment, with a retention of five to six pounds of Grade 1 creosote to the cubic foot of wood.

Within two or three years difficulty began to be encountered in the procurement of all-sap staves, and as this class of material eventually all but disappeared from the market, the specifications were modified to include heartwood and admit longleaf pine. At the same time, the treatment was changed to the full cell process, with requirement for a retention of 15 to 16 lb. of creosote, the purpose being to get better penetration of the heartwood. Complete penetration of the staves and bottom plank is now obtained only in rare cases; yet experience has shown that on the average 75 per cent of the timber receives treatment, that the minimum penetration is ½ in., even in the densest heartwood, and that most of the timber is penetrated up to 1 in.

These provisions of the material and treatment specifications have been

Save Steel for War

Materials for Victory

No. 4 of a Series

The railways are such large consumers of steel, and use it for such a great variety of purposes that when substitute materials can be found for any of these uses they release a substantial amount of this critical material for war purposes. This article, the fourth in a series on Materials for Victory, shows how creosoted wood can be substituted satisfactorily for steel in water-tank construction. The first article in this series dealt with the use of timber connectors to make possible the utilization of wood as an alternate for steel in railway construction; the second described the scrap collecting program on the Illinois Central, and its amazing results; and the third article described the methods in effect on the New York Central system to conserve rail and fastenings

so satisfactory that they have remained unchanged since their adoption more than 20 years ago. These requirements are not the only factors, however, which are responsible for the excellent results that have been obtained from creosoted tanks, for no small credit must be given to insistence on thorough seasoning before framing and treatment.

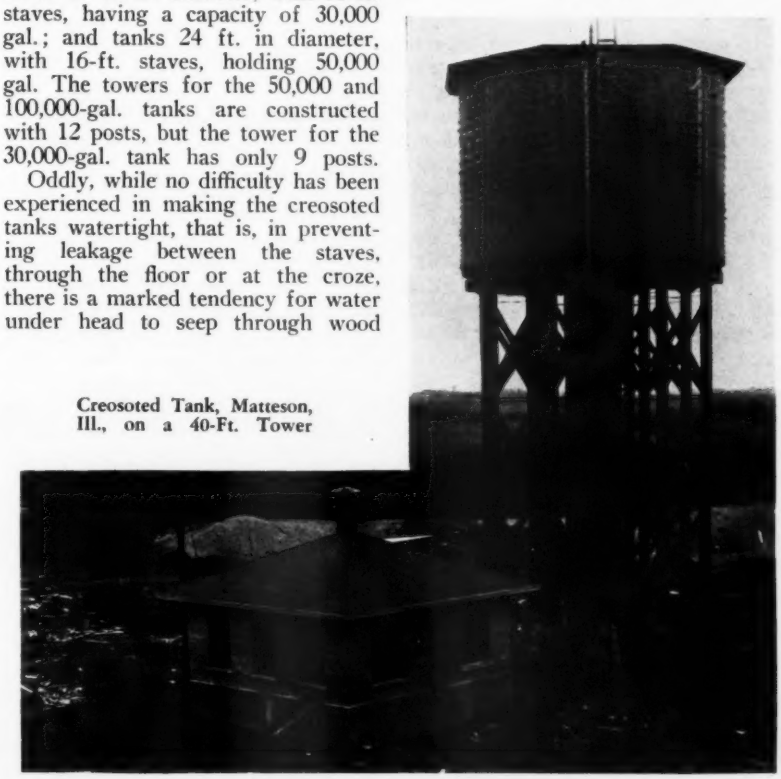
Both the framing, by company forces, and the treating are done at Grenada, Miss. The treating plant at this point is equipped for framing bridge and other timbers used for ordinary construction, but has no special machinery for framing tanks. However, the staves and bottom plank are surfaced to size and the staves are given the correct bevel in the planer. The croze is also cut by machine, but it has always been necessary to frame the bottom planks by hand.

No Tolerance Allowed

Two features that have been insisted on since the beginning are that the framing shall be done with the utmost care, and that the dimensions shall conform to those shown on the plan, practically without tolerance. These requirements have been so impressed upon the forces doing the work that it has been necessary on only a few occasions to bore a hole in a treated timber during erection, and no difficulty has been experienced in making watertight any one of the 166 tanks that have been erected to date. Every stick entering into the completed tank is pre-framed, including the posts and the bracing for the tower, the rafters and purlins for the roof and the frame for the frost box, except the 1-in. plank for roof sheathing and for sheathing the frost box. All holes are prebored, including those for the dowels between the staves. The reason for excepting the 1-in. plank is that it is completely penetrated by the preservative and can, therefore, be cut with impunity to fit during erection.

The first creosoted tanks erected on the Illinois Central were 30 ft. in diameter, with 20-ft. staves, having a capacity of 100,000 gal. Since then two other sizes have been added, to equip stations where less water storage is required. These sizes comprise tanks 18 ft. in diameter, with 16-ft. staves, having a capacity of 30,000 gal.; and tanks 24 ft. in diameter, with 16-ft. staves, holding 50,000 gal. The towers for the 50,000 and 100,000-gal. tanks are constructed with 12 posts, but the tower for the 30,000-gal. tank has only 9 posts.

Oddly, while no difficulty has been experienced in making the creosoted tanks watertight, that is, in preventing leakage between the staves, through the floor or at the croze, there is a marked tendency for water under head to seep through wood treated with straight creosote and this is no less noticeable where the full-cell treatment is used than with the Rueping process, in which the cells are open. To overcome this difficulty, before the tank is put in service the interior surface is given a coat of sealing compound containing asbestos fibre, this material being the



Creosoted Tank, Matteson, Ill., on a 40-Ft. Tower

same or similar to that applied to boiler settings. However, some of the material for later tanks has been treated with a solution of creosote and coal tar, and it has been found that this preservative seals the wood against seepage of the water, so that application of the sealing compound becomes unnecessary.

An excellent opportunity has been afforded to inspect the tanks thoroughly and determine their condition after varying periods of service, by reason of rearrangements of facilities which have necessitated the moving of some of the tanks from their original location. Preparatory to moving the first tank, it was estimated that it could be dismantled and re-erected on the new site as cheaply as it could be moved intact, besides which, the possibility of damage and of interference with other operations was eliminated. This method has been followed in all subsequent cases where tanks have been moved, and 35 tanks, or more than one-fifth of the total, have been moved in this way.

In the detailed inspection which has been possible in connection with the dismantling of the tanks, none of the treated wood has shown any indication of decay or other forms of failure, except for a few staves that have split; that is, there has been a separation or cleavage between the heartwood and the sapwood, after they were placed in service.

The first tanks were erected with flat hoops, in accordance with the practice of the period, but these hoops demonstrated the same undesirable qualities with creosoted tanks as was characteristic of them when used with the untreated tanks. For this reason, as it became necessary to replace them, round hoops were substituted, and today none but round hoops are used.

How Many Built

Since the first tank was erected in 1917, a total of 165 others have been placed in service. Of these, two showed such evident signs of failure that it became necessary to dismantle them. When the reasons for these failures was sought it was found that at the time the seasoning of the timber was completed, owing to war conditions, there was a shortage of creosote and the material could not be given the usual treatment. As a precautionary measure, it was framed and treated with zinc chloride and returned to the yard. Whether it became infected before or after this precautionary treatment could not be learned, but it was established definitely, that it was infected at the time it was creosoted. Yet, despite this handicap, both tanks lasted for 20 years before it became necessary to dismantle them.

All of the remaining tanks, 164 in number, are still in service, including the seven tanks erected in 1917. What the ultimate life of these structures will be is largely a matter of opinion, because there is no previous experience with this type of construction, which can be employed as a guide. Estimates vary from 40 to more than 50 years. In any event, there is general agreement that these early tanks are still sound, and that none of them exhibit any indication of approaching failure. In this connection, it is of equal interest that the first creosoted tank tower, erected at Galena, Ill., in 1904, is still in service and that the timber is sound after 38 years.

Records of Service

It will also be of interest to compare this prospective life with the service obtained from other wooden tanks. An investigation made several years ago included 174 tanks then in service and 126 that had completed their service life, a total of 300. The information concerning these tanks was obtained from nine roads and referred to structures of redwood, cypress, white pine, yellow poplar, red cedar and yellow pine, none of which had been given preservative treatment. Of the tanks still in service, 77 redwood tanks had an average life of 32.6 years; 57 cypress tanks had an average life of 27.5 years; and 40 white pine tanks had a service life, as of the date of the inquiry, of 31.3 years. The average life of all of these 174 tanks was 30.5 years. It should be kept in mind however, that these tanks were still in service and that the record represents only their life to that time and not their ultimate life.

Against this record, 43 cypress tanks that had completed their service life had an average life of 29 years, with a maximum of 32 years; 78 white pine tanks had an average life of 27 years, with a maximum of 38.3 years; 3 yellow poplar tanks gave an average service life of 30 years; 1 red cedar tank was dismantled at the end of 28 years; and 1 yellow-pine tank lasted for 29 years. The average life of all of the 126 tanks was 28 years. If the foregoing figures are representative, and they are believed to be, for enough tanks and enough roads were included to make them typical, the service that can be expected from creosoted-wood tanks, places them in a favorable position with respect to even the best of the untreated woods, namely, redwood, cypress and white pine.

Query is often made as to the relative fire risk of the creosoted and untreated woods. Obviously, any wooden tank may be destroyed by fire as readily as any other frame structure. Yet wooden tanks have an excellent record of immunity to fire and, whether treated or untreated, are not so great a risk as they are generally supposed to be. It is also established that after the surface of creosoted timber has dried and particularly after the timber has become well seasoned, it is more difficult to get a fire started in it than in untreated wood. On the other hand, if the creosoted wood does catch fire, it generally burns much more vigorously until the creosote has leached out of the wood. The most important evidence on this point, however, is that during the quarter-century that creosoted tanks have been in service on the Illinois Central, not one has been destroyed by fire.

No Contamination

Mention was made of the fear that creosote from the treated timber might contaminate the water and render it unfit for locomotive use. A similar question was raised a number of years ago with respect to a proposed 56-in. creosoted-woodstave pipe, 22½ miles long, to conduct water from the Landsberg intake, on the Cedar river, to the Volunteer Park reservoir, in Seattle, Wash. Extensive tests to determine what effect, if any, might be expected, were conducted by the Bureau of Industrial Research of the University of Washington. The conclusion of the Bureau was that the creosote caused no detrimental effect so far as either industrial or domestic uses were concerned. This finding has been borne out fully by the experience of the Illinois Central with creosoted water tanks.

At present steel is needed so desperately for munitions and other military and naval purposes that it is difficult to justify its use for the construction of water tanks, provided a satisfactory substitute can be found. While the Cleveland, Cincinnati, Chicago & St. Louis took the initial step to substitute wood for steel in water tank construction, the Illinois Central expanded the development. More recently, the Louisville & Nashville has erected a number of creosoted tanks, and several others have followed the practice to a less extent.

These three roads have established that the creosoted wood water tank can be used successfully and is entirely satisfactory from the standpoints of operation and economy as a substitute for steel. By making this substitution, the more critical material will be released for uses for which there is a greater need.

Roadmasters
Face Responsibilities of War-Time Maintenance

Program at three-day annual meeting held in Chicago gives consideration to materials, labor, scrap and reclamation, car shortage, increasing the life of rail, equipment maintenance and other pressing problems. Members hear representatives of WPB, ODT, AAR, the Army, and others in intimate touch with the railways' war effort, and witness a constructive exhibit of materials and equipment presented by the Track Supply Association. A complete report of the meeting is published herewith, except for certain addresses, which will be presented in subsequent issues.

IN an atmosphere made tense with a realization of the magnitude and seriousness of the wartime problems confronting the railroads, and especially the maintenance of way forces, members of the Roadmasters' and Maintenance of Way Association met in Chicago on September 15-17 for one of the most intensive and constructive meetings in the long history of their association. Throughout the seven sessions of the meeting, the program was keyed to the war effort of the country and the railroads, giving special emphasis to the most critical problems of the moment, including those pertaining to track materials, labor, the car supply, scrap and reclamation, accident prevention, the most effective use and maintenance of work equipment, and the enlarging war-time responsibilities of maintenance men.

Many Prominent Speakers

Seeking the highest authorities on these various matters, those addressing the meeting included C. E. Johnston, chairman, Western Association of Railway Executives and associate director, Western region, Office of Defense Transportation, Chicago, who opened the meeting with a citation of the problems confronting the railways and a challenge to every maintenance man to do his part; Otto S. Beyer, director, Division of Transport Personnel, Office of Defense Transportation, Washington, D. C., who spoke on Our Track Labor Problem; B. C. Bertram, director of railway salvage, War Production Board, Washington, D. C., who spoke on Track Scrap—Its Importance in Our National Program; W. W. Kelly, director, Section of Materials and Equipment, Office of Defense Transportation, Washington, D. C., who discussed The Outlook for Track Materials; and W. C. Kendall, chairman, Car Service Division, Association of American Railroads, Washington, D. C., who discussed The Use of Cars and Locomotives by Maintenance of Way Forces in These Days of Maximum Traffic Demands.

Others who addressed the meeting included Brig. Gen. Carl R. Gray, Jr., general manager, Military Railway Service, St. Paul, Minn., who, at a special session on Tuesday night, described the purpose and work of his organization; F. R. Layng, chief engineer, Bessemer & Lake Erie, Greenville, Pa., who spoke on Our Responsibilities as Track Men in a Time of "All-Out" War; and C. M. Chumley, engineer maintenance of way, Illinois Central, Chicago, who, speaking of scrap, told of the outstanding success being achieved in a continuing drive on his road. Technical reports were presented on Extending the Life of Rail and Fastenings, by a committee of which J. B.

Martin, general track inspector, New York Central, Lines West of Buffalo, Cleveland, Ohio, was chairman; The Control of Injuries Under Today's Changing Conditions by a committee of which S. J. Hale, assistant division superintendent, Norfolk & Western, Roanoke, Va., was chairman; The Maintenance of Roadway Equipment, by a committee of which Ray Marshall, district roadmaster, Great Northern, Superior, Wis., was chairman; Recent Developments in Tamping Practices, by a committee of which A. B. Chaney, district engineer, Missouri Pacific, Little Rock, Ark., was chairman; Highway Crossing Maintenance and Construction, by a committee of which F. E. Schaumburg, roadmaster, Chicago & North Western, DeKalb, Ill., was chairman; and The Use of Track Grinders, by a committee of which F. J. Herlehy, roadmaster, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis., was chairman.

Summing up at the closing session on Thursday, Elmer T. Howson, editor, *Railway Engineering and Maintenance,* reviewed the many helpful ideas brought out during the meeting. In his remarks, Mr. Howson characterized the meeting as the most constructive and timely in the long history of the association, and commended to all maintenance men a careful study of the addresses and reports presented at this meeting in the interest of helping them face and solve their increasing war-time problems.

The meeting, which was the fifty-seventh annual meeting of the association, was supplemented, as in past years, by an exhibit of maintenance of way materials and equipment, presented by the Track Supply Association. Both the meeting and the exhibit were held in the Sherman hotel, a new headquarters selected when the long-standing meeting place of the association, the Stevens hotel, was taken over by the Army for a radio school late in the summer. More than 270 railway officers registered their attendance at the meeting, the total attendance, including exhibitors, being more than 350.

President's Address

All sessions of the meeting were presided over by A. B. Hillman, engineer maintenance of way of the Chicago & Western Indiana and the Belt Railway of Chicago, and president of the association. In his presidential address, Mr. Hillman spoke of the long and enviable record of service of the association through the last 57 years, reviewed its activities during the last year, and saw grave responsibilities for both maintenance men and the association in the months ahead. He said in part, as follows:

"We are now faced with the responsibility of keeping our railroads functioning to meet the war effort. In our country's 'all-out' effort to hasten the complete destruction of the Axis powers, the railroads are playing a vital part in the transportation of men and materials, and the maintenance department is being called upon to keep the roadbed and tracks of the railways in condition to handle promptly and safely the greatest traffic in history. This must be done with a decreasing supply of manpower, with limited materials, locomotives and cars, and with no interference with the operation of trains. This new era in railroading makes it more important than ever that our association meet here to provide all possible assistance to its members in solving the new problems that are confronting them daily. Through our meeting we will increase the efficiency of the maintenance of way department in this period of war, and thereby increase the speed and safety of rail transportation."

A. B. Hillman
President

Mr. Hillman, who is engineer maintenance of way of the Chicago & Western Indiana, and the Belt Railway of Chicago, with headquarters at Chicago, has had extensive experience in terminal maintenance matters, having been connected with these two important terminal properties in various capacities throughout most of his railroad career. He joined the association in 1937, and served in its various offices prior to his election as president.

H. R. Clarke Sounds Warning That Essential Materials Are Needed

Bringing greetings to the meeting from the American Railway Engineering Association, H. R. Clarke, its president, and chief engineer maintenance of way of the Chicago, Burlington & Quincy, expressed the greatest confidence that maintenance of way men will do their part in meeting the increasing demands of the country's war effort, but viewed with deep concern the tendency in some quarters in Washington to expect that the railways can continue indefinitely to maintain their remarkable record of performance to date, no matter what future restrictions are imposed on their ability to secure their minimum essential requirements in materials and equipment. He said in part, as follows:

"Today we are at war with the most militaristic and ruthless nations of modern times. Our task now is to win, as quickly as possible, and with the utmost decisiveness. The railways have a tremendous load to carry, a vital job to do, and we, who are responsible for maintaining the tracks that serve war industries and carry war traffic, troops and supplies, have an important part in the total effort required.

"Not long ago, Joseph B. Eastman said, 'Maintenance must not be allowed to fall into arrears, and no one has a heavier and graver responsibility than the men who are in charge of this work.' Certainly no one is more fully alive to what will happen if maintenance should fall too far in arrears than are the men on the firing line, who are carrying the responsibility that Mr. Eastman was speaking of. No one knows better than they the difficulties that confront them, and none is more grimly determined that they shall not fail.

"So far the railroads have done a splendid job. That is generally recognized and the roads have been complimented by many who are in the best position to know just what has been done. The fear has been expressed by some that we might become self-satisfied and complacent, and feel that our part was done—our battle won. I have no fear that such an attitude will develop. That has not been our training. We believe that no matter how well the job is done, it can be done better. If failure should come, it will not be due to lack of determination and effort on our part.

"There is one thing which does give us all deep concern. As I have

said, the railroads have been complimented on the splendid job they have done, and confidence has been expressed that they will continue to deliver the goods. Some in authority know that to do this the railroads must have reasonable amounts of vitally needed materials and be protected in their labor supply to the same extent as other essential war industries. Mr. Eastman and some of his staff know this, and in them we have influential friends at court. But is that enough? A member of the War Production Board said recently, 'But the railroads have met successfully all demands imposed on them up to now as a result of the war program, and I am supremely confident that the job will continue to be done, no matter what further restrictions are necessary.' I wonder if those with such thoughts ever heard that 'you cannot make brick without straw.' Every railroad employee will do his utmost to deserve and justify the confidence expressed, and I believe the situation can and will be presented in such a way by those who do understand it that the tragic phrase, 'Too little, too late', as regards maintenance needs, will not apply.

"Regardless of difficulty and restrictions, there is much that each of us can do in recruiting labor, organizing it to the best advantage, and increasing efficiency generally. We can do much in conserving materials and in using what we have where it is needed most. We can see to it that neither labor nor material is wasted; that no more material is asked for than is absolutely needed; and that no material is ordered until we are ready to use it. Material lying around unused on a railroad may be needed desperately somewhere else on that railroad or on another railroad to prevent a serious breakdown in performance. 'Too little, too late' would be tragic and perhaps fatal, but 'too much, too soon', would also be failure on our part. Both are yardsticks by which all our requests can well be measured. This is our responsibility."

Others Extend Greetings

R. E. Dove, assistant engineer, Chicago, Milwaukee, St. Paul & Pacific, and president of the American Railway Bridge and Building Association, brought greetings from that association, commending the Roadmasters for their long record of achievements, and urged them to still greater effort in the interest of the railways and the country in this time of national emergency. Speaking in behalf of the Track Supply Association, R. M. Blackburn, Buda Company, president of the association, and Lewis Thomas, Q. & C. Company, secretary-treasurer of the association, offered the fullest co-operation on the part of members of their association in meeting the needs and solving the many new and difficult problems confronting maintenance of way men.

New Officers and Subjects

In the election of officers at the closing session on Thursday, E. L. Banion, roadmaster, Atchison, Topeka & Santa Fe, Topeka, Kan., was advanced from first vice-president to president; H. E. Kirby, assistant engineer, Chesapeake & Ohio, Richmond, Va., was advanced from second vice-president to first vice-president; J. M. Miller, trainmaster, Western Maryland, Cumberland, Md., and a director of the association, was elected second vice-president; and E. E. Crowley, roadmaster, Delaware & Hudson, Albany, N. Y., was re-elected treasurer. Four new directors were elected—A. B. Chaney, district engineer, Missouri Pacific, Little Rock, Ark., and F. E. Schaumburg, roadmaster, Chicago & North Western, DeKalb, Ill., for four years; Ray Marshall, district roadmaster, Great Northern, Superior, Wis., for two years to fill the unexpired term of P. Chicoine, retired roadmaster, Canadian Pacific, resigned; and S. J. Hale, assistant superintendent, Norfolk & Western, Roanoke, Va., for one year to succeed Mr. Miller, elevated to second vice-president.

The report of the secretary, A. G. Shaver, showed 836 members of the association, including 44 new members taken in during the year. According to present plans, the next annual meeting will be held in Chicago. The subjects selected for study by committees during the ensuing

E. L. Banion
First Vice-President

H. E. Kirby
Second Vice-President

A. G. Shaver
Secretary

E. E. Crowley
Treasurer

Roadmasters' Association

Officers 1941-42

A. B. Hillman, president, engineer maintenance of way, C. & W. I.—Belt Ry. of Chicago, Chicago.

E. L. Banion, first vice-president, roadmaster, A. T. & S. F., Topeka, Kan.

H. E. Kirby, second vice-president, assistant engineer, C. & O., Richmond, Va.

A. G. Shaver, secretary, Chicago.

E. E. Crowley, treasurer, roadmaster, D. & H., Albany, N. Y.

Executive Committee

John J. Clutz, past-president, Lt. Col. 730th. Engineer Battalion, Railway Operating, Ft. Wayne, Ind. (formerly div. engr., Washington Terminal).
(Term Expires September, 1945)

F. J. Meyer, chief engineer, N. Y. O. & W., Middletown, N. Y.

A. L. Kleine, division engineer, D. & R. G. W., Salt Lake City, Utah.
(Term Expires September, 1944)

R. L. Fox, roadmaster, Southern, Alexandria, Va.
(Term Expires September, 1943)

J. M. Miller, division engineer, W. M., Cumberland, Md.

E. J. Brown, assistant division superintendent, C. B. & Q., Galesburg, Ill.
(Term Expires September, 1942)

R. S. Kniffen, general roadmaster, G. N., Duluth, Minn.

F. J. Liston, assistant superintendent, C. P. R., Smith's Falls, Ont.

year for presentation at that meeting are as follows: Getting the Most from Crossties; Educating Track Labor in the Salvage of Materials; Saving Labor Through the More Intensive Use of Equipment; Extending the Life of Switches, Frogs, and Crossings; Housing Track Labor; and Reducing the Use of Revenue Cars in Non-Revenue Service.

All of the committee reports presented at this year's meeting, with abstracts of the discussions which followed their presentation, as well as abstracts of the addresses by Messrs. Johnston, Kelly and Chumley, are presented in this issue. The addresses by Messrs. Bertram, Beyer, Kendall, Layng and Gen. Gray will be presented in subsequent issues.

C. E. Johnston Opens Meeting With Challenge to Maintenance Men

C. E. Johnston

OPENING the meeting with a challenging address, C. E. Johnston, chairman, Western Association of Railway Executives, and assistant director, Western region, Office of Defense Transportation, reviewed the war problems confronting the railroads; stressed the vital importance of the adequate and safe maintenance of the railway roadbed and tracks—a task which he characterized as "second to none in importance"; and urged maintenance of way men to still greater activity and aggressiveness in the interest of solving the problems confronting their department. He said in part, as follows:

"In this greatest crisis in the life of our nation, the railroads occupy a particularly important part. They play a dual role. Essential to the economic order of our people, vital to their comfort, their health and their very lives, the railroads are no less essential, no less vital, no less indispensable to our armed forces and their prosecution of the war. As has been said repeatedly, this is a battle of production. Transportation is the beginning and the end of our industrial production, in war as well as in peace. In the winning of this war, the railroads are the first line of production. Our patriotic duty and job as railroad men is to keep that line open—to operate the service of supply. I know that we will not fail, no matter how great the task.

"And the task will be the greatest and the most difficult we have ever known. Already, the railroads are faced with the heaviest service demands ever made upon them. So heavy, indeed, have been these demands that thus far this year they have performed a revenue transportation service amounting, on the average, to the movement of more than a million tons of freight for the distance of one mile every minute of every day. That is the greatest transportation job ever carried out in the history of the world.

"In passenger service, the increase in demand upon the railways has been even more striking. The peak level of passenger business was reached in 1920, following which very great declines occurred. Last May, however, the 1920 level was exceeded for the first time, and current figures of revenue passenger miles show increases of almost 80 per cent over 1941 and 125 per cent over 1940. Thus, passenger traffic too, is at an all-time high.

"With these increased demands upon them, the railways must pay first attention to the movement of troops and vital war materials. And the movement of war materials is a much larger job than it was during the last war. Today, it takes more than half again as much in the way of materials and supplies to keep a fighting man in the field. Likewise, it takes a large volume of transportation to provide all of the trucks, tanks, jeeps and planes that are used in modern war, and to keep them supplied and running and flying. Every change that has been made has increased the transportation load.

"Some idea of the magnitude of the military demands being made upon the railways may be gained from the fact that the movement of an infantry division of about 15,000 men and its equipment requires 65 trains, with a total of approximately 1,350 cars. The transportation of the men and the 3,000 vehicles comprising an armored division requires about 75 trains of from 28 to 45 cars each, depending upon the length of the cars.

"As I have already said, our task in winning the war will be the greatest and the most difficult we have ever known. It will be even greater and more difficult tomorrow than it is today. Your part in the struggle—the safe and adequate maintenance of the railway roadbed and tracks—is second to none in its importance.

"In spite of the increased volume of traffic ahead, there will be shortages in roadway maintenance materials and in the trained labor for applying these materials. We will be called upon to do more and more with less and less. We will have to do the best that we can with what we have, and our very best will be none too good.

"Essential though the railroad industry is, we can anticipate, nevertheless, as the war goes on, that more and more railway men, including those in your department, will be called for active service with our armed forces. We can anticipate, likewise, that the supply of men who normally would be available for railroad employment will be depleted through this same cause and through the demands of other war industries. One of the most important elements of our job today is to look to the future and to make all possible plans to meet, as best we can, this probable shortage of trained man-power. This will test our resourcefulness, our energy, our driving power and our patriotism. In my judgment, there will be no question as to the ability of maintenance men to meet this acid test, because I know the 'stuff' of which they are made.

The Office of Defense Transportation is making every effort to see that the railways obtain their essential requirements of materials. But, at best, the most that can be hoped for is a bare sufficiency in many regards. None of you will get all that you want, but we will try to see that all of you get what you absolutely need. At the same time, an important element of your job today is conservation, salvage and the intelligent use of imagination and resourcefulness in the

development and use of substitute plans and materials which will enable the railroads to continue to meet all of the demands made upon them.

"There is a third factor that will complicate your work. As our normal production becomes more and more curtailed, a higher and still higher proportion of railroad traffic will consist of war materials. As a result, the peacetime seasonal fluctuations in the volume of rail traffic will be largely wiped out. There will be no slack periods—no breathing spells. On the contrary, it appears that the demands upon the railways will grow almost steadily from month to month. Your task will be made even more difficult by this fact.

"Our big job today, tomorrow, next week and every day until the surrender of our enemies is to win the war. Our specific part in this job is to maintain the life-line of the nation. And on that day when we celebrate our final victory, the railroads and every railroad man can look the world in the face and say, 'We did our job—may we and our families, our country and the world live in peace forever.' "

The Maintenance of Roadway Equipment

Report of Committee

Ray Marshall
Chairman

THE rapid expansion in the use of roadway equipment by maintenance of way forces in recent years has created the problem of keeping this equipment in proper condition for its most efficient and reliable operation. Our large investment in maintenance machinery earns a return only by doing more and better work than can be done by archaic hand methods. These inherent benefits are lost, however, when these machines are poorly and inefficiently maintained. It cannot be over-emphasized that breakdowns caused by neglect and misuse result in exceedingly expensive delays, particularly when they disrupt the operations of large gangs built around mechanical aids to track maintenance and construction. Doubly serious are those failures that interfere with the normal operation of trains.

Possible Shortage of Machines

Elemental as the importance of well-cared-for roadway machines is in securing the greatest return from their use, the need of an adequate organization for the operation and maintenance of such machines is even more imperative under existing conditions. We are at war. While many of us may wish to obtain additional machines or to replace old equipment with improved units, the tenor of the times demands that we get the maximum possible from the machines we now have. Under the war conditions that are developing, it is quite probable that we will be wholly unable to obtain new machines, and it is very possible that we will have almost equal difficulty in obtaining repair and replacement parts for the machines we now have. The problem is further aggravated by the decline in available manpower.

The situation does not look very bright. It calls for careful study and full use of the energy, available resources and ingenuity which we possess if we are to obtain the full value from our present mechanical aids to track maintenance.

The mechanization of the maintenance of way departments has, at best, been somewhat haphazard. The earliest equipment, such as cranes, pile drivers, shovels, ditchers, etc., was largely steam-driven, and usually track-bound, the repair of which was delegated customarily to the mechanical department. The introduction and use of motor cars first brought to our attention the problems of maintaining internal combustion engines. In these early days, with no facilities or gas engine mechanics, we sidestepped the issue and prevailed upon the mechanical department, water service foremen or any itinerant mechanics with some gas engine experience to "get her workin'." Even as greater numbers and types of roadway machines came into use, little thought was given the problem of their maintenance. Thus, many roads found themselves in the midst of the present machine development with a bulk of equipment that had outrun its organization and supervisory set-up, an organization and set-up which had been fashioned for the hand-car era. This, obviously, was hardly conducive to obtaining the maximum return from the investment in power tools and equipment. Frequent irritating and expensive break-downs, with consequent delays and interruptions to work, were experienced. Some means of eliminating such aggravating and costly failures had to be provided.

Machine failures were eliminated as a major factor on many roads by giving proper attention to their organizations for the maintenance of roadway equipment. In creating, renovating or modernizing earlier organizations, several procedures have been followed, as must necessarily have been the case in view of the diversified physical characteristics of our American railroads. Whether a road is large or small; has many or few units to maintain; is serving a compact or extensive territory; all of these and many other factors have influenced and will continue to influence the determination of the type of maintenance-of-equipment organization best suited to a specific road.

Mechanical vs. Maintenance Shop

On every railroad, however, the problems of maintenance of roadway machines fall into three broad categories. First, there is the need for making heavy or general shop repairs to the various units, together with major emergency work. Second, adequate attention must be given to the machines in the field, including periodic inspections and the making of running repairs, and third, there must be proper selection and training of machine operators.

Some roads have found it advisable to have the mechanical department handle the maintenance work outlined in the first of these three classifications, either because of a limited number of machines on the system, or,

possibly, as a result of the precedent set by that department's handling of the original heavy steam equipment repairs for the maintenance of way department. This precedent was easily and naturally followed and expanded into the field of internal combustion engine repairs.

The consensus of your committee, however, is that on the larger railroads, an organization existing exclusively for the purpose of maintaining roadway equipment is the ideal solution. An organization of this type has many advantages. Better results are obtained where the repair work is of primary importance to those handling it. Often, repairs are given secondary consideration when performed by some other department. The men of the organization become more familiar with the design and construction of the machines in their charge than is possible where the work is delegated to another department. They are in closer contact with the equipment when in use, and hence are in a better position to know how it is used, what is to be expected from it, and what is wrong when it becomes balky. Above all, the responsibility for the proper operation and maintenance of the equipment is not divided.

This organization contemplates a system officer subordinate to the general officer in charge of maintenance of way and structures. He should be responsible on the one hand for the selection of new machines, their procurement and the allocation of the power tools and equipment used by maintenance forces. On the other hand, he should give general supervision to the operation and maintenance of these tools and machines. These duties are complementary in that the knowledge gained in the maintenance and operation of machines can be applied with profit to the selection, procurement and allocation of machines, and vice versa. This officer must be thoroughly familiar with the requirements of the track and structures of the system in order that he will never lose sight of the basic function of the maintenance of way department—the keeping of this portion of the railroad's physical plant in proper condition. To achieve this aim, there must, of necessity, be close co-operation with local supervisors.

Field Machine Maintainers

Preferably, the organization for maintaining roadway equipment should be built around the shop or shops which handle the heavy repairs. Under the foreman in charge of each shop there should be mechanics and laborers, or apprentices, in number adequate to handle the normal flow of work. Working out from the shop, and under the supervision of the shop foreman, there should be a group which, for the sake of convenience, may be referred to as "field machine maintainers," sufficient in number to cover adequately the territory assigned them. The following enumeration of their functions has been compiled. This, of course, is not intended as a hard and fast listing, and it may be expanded or contracted to suit the needs of the individual supervisor and road. However, the items listed are deemed fundamental functions of the field machine maintainers:

1) The determination of the general condition of machines by periodic inspections.

2) The anticipation of the need for minor running repairs.

3) The acquisition of replacement parts for such anticipated repairs.

4) The carrying out of light field repairs.

5) The determination of the need for a general shop overhauling of machines, and the submission of work reports to shop foremen, covering heavy repairs known to be required.

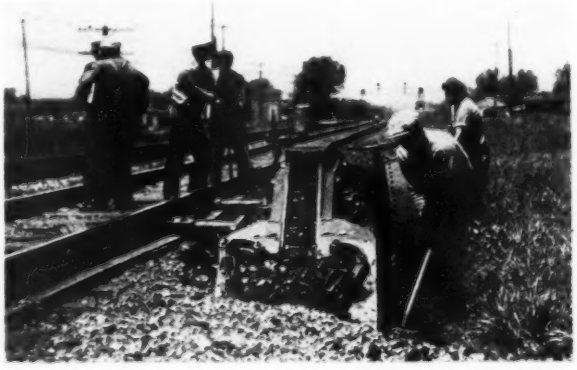
6) The education of machine operators in the proper operation, use and care of the individual machines. This is of especial importance at the present time, because the rapid turn-over that is taking place in labor makes more necessary than ever some efficient means of training and checking on new employees.

Whether such a maintenance organization should work in and from a single centralized system shop or on a divisional or regional basis depends largely upon the geographical disposition of the road. Certain roads have found it to their advantage to centralize their facilities. Although these roads may have a large total mileage, that mileage is usually confined to a relatively small area so that at no time are the machines at a point excessively far from a central shop. However, on other roads, particularly those in the west, where the track layout is what might be termed "straight-track" as distinguished from a network, the situation is quite different. It then becomes advantageous to establish shop facilities at convenient intermediate points, usually one on each division. This obviates the necessity for making shipments over great distances, with the resultant long periods that equipment is out of service. Another consideration is the fact that on these latter roads, the administration of field repairs is unwieldy without some type of subdivision.

Effect of the War

The war has had an extremely important effect upon attempts to arrange programs of regular shop repairs. Increased traffic density, necessitating more intensive track maintenance, has created heavier demands on maintenance equipment; also, diversified uses have been found for a number of machines, resulting in intensified utilization. Some roads have inaugurated the practice of double, and even triple, shifting such equipment as electric welding units, weed burners, gravel processing plants and earth-moving equipment. This practice is traceable not only to the war effort, but to the growing belief on the part of many maintenance officers that it is practical and desirable to utilize certain equipment in that manner. Intensive operations, when confined to their proper sphere, repeatedly have shown themselves capable of making substantial savings. Better work coordination is the keynote. Because of the factors outlined, namely, the greater need for roadway machines, the greater utilization of equipment and the expanded use of machines, it has become imperative that the frequency of shopping be reduced to a minimum in order that there be as little delay as possible in the operation of this maintenance equipment.

Except for programming repairs to seasonal machines, there should be no necessity for sending a machine into



Field Machine Maintainers Should Visit All Equipment Periodically and Discuss Its Operation and Maintenance With the Foreman and Its Operators

the shop so long as it can be kept working satisfactorily in the field. Neither over nor under-maintenance can be justified in these times of critical shortages of machines, materials and manpower. Either will eventually result in the use of a greater total of these commodities than when more effort is directed toward periodic inspection and light field repairs with the intention of complete overhauling in the off-season or when the general condition of non-seasonal machines makes it essential. Machine maintainers have proved that they can effect considerable economies by this practice and avoid the necessity for periodic shopping. This procedure results in keeping the machines on the job, available for work and avoids the need for frequent trips to the shop.

Field Repairs

As outlined previously, on roads which have a roadway equipment maintenance organization, field repairs should be made by the field maintainers. In some instances it has been found desirable to equip these employees with light panel trucks so that an adequate supply of tools and parts which are subject to severe wear, or are most likely to fail, may be immediately at hand. Included among these tools should be a wheel-puller, a vise, and a cutting and welding torch. Whether it is feasible to provide trucks on a given railway depends to a large extent upon its physical characteristics. Even though it may be impossible or inadvisable to equip maintainers with trucks, they should be provided with essential tools, including those special tools necessary to the machines under their care.

On roads which have no machine maintenance organization, the field maintenance of machines, of necessity, devolves upon the machine operators. This arrangement may at times require the assistance of commercial shops if no railroad shop facilities or skilled mechanics are available.

Education of Machine Operators

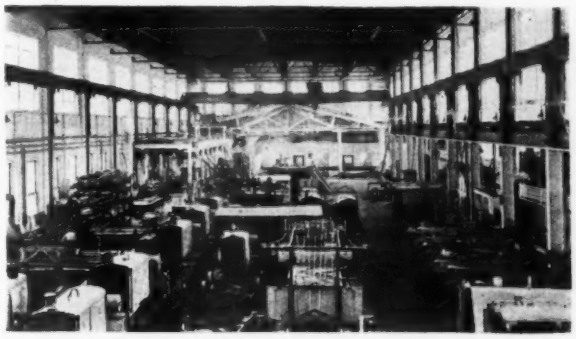
One of the greatest advantages to be derived from field machine maintainers is the saving effected through their efforts in educating machine operators in the proper use, daily servicing and required adjustments of their machines. The importance of the proper training of operators cannot be over emphasized. No single factor is as vital in obtaining the maximum productive capacity from a machine.

It should be impressed upon all operators that their primary function is to get the maximum work out of the machines in their charge. Unquestionably, operators should make those light repairs and adjustments within their capacity, but they should not become "tinkerers." Their job is to operate the machines; produce with them, not experiment on them. Not only is time wasted in ineffective tinkering which should be spent in effective work, but real damage is often done. Servicing, adjustments and minor replacements of parts should ordinarily constitute the limits of the operator's mechanical maintenance endeavors.

Most roads have found that exceedingly fertile sources of repairs are the failure of operators to lubricate their power tools properly, to keep bolts tightened, and to keep their machines clean and protected from the elements when idle. The careless neglect and abuse of a machine are inexcusable; they curtail its life, make frequent repairs necessary, and make it unreliable. Proper lubrication means more than merely keeping oil in the crankcase. It means periodic servicing with the right types and grades of lubricants.

Specialized lubrication is required for special machinery. Just "oil" won't do. The manufacturers of our equipment make specific recommendations as to the types and grades of lubricants to be used. These recommendations are based on extensive research and experience. It follows that the only way we can obtain the maximum possible service from our power tools is to take the benefit of that research and follow the manufacturers' recommendations. It also follows that not only must proper lubricants be furnished, but also that these oils and greases should be kept in suitable containers to prevent contamination and properly labeled to prevent confusion.

It has been the experience of your committee that if operators are to be fully cognizant of these essential features of their jobs, these facts must be emphasized repeatedly and checked by visits from the field machine maintainers. This training is done during the maintainers' usual rounds of inspection and maintenance. There is no more effective means of inculcating the requisite knowledge into a road's force of operators than by this method. Most maintenance of way officers are too occupied in solving the problems of track and structures to have the time necessary to make detailed inspections of the various machines and to educate the operators.



The Well-Organized and Laid Out Roadway Equipment Maintenance Shop of the New Haven at New Haven, Conn.

Should Maintenance Shops Handle Heavy Repairs?

This question divides itself into two phases. First to be considered is that phase dealing with heavy equipment. Except on those railroads having many units of such heavy equipment as locomotive cranes, pile drivers, mechanical spreaders and steam, gas and diesel shovels, it is the opinion of your committee that such overhauling and heavy repairs to equipment coming under MCB and ICC rules and regulations should be performed in mechanical department shops. This belief is based on a number of factors, chief of which is the existence of facilities and personnel in these shops familiar with and capable of handling this type of equipment. Years of experience of mechanical department employees should not be wasted by any reorganization. Also, on many roads, the cost of duplicating existing facilities would be wholly out of proportion to the amount of work which is necessary to the maintenance of large equipment. A further impediment in the way of change on most railways is the restrictions of labor schedules.

The extent to which heavy repairs to the lighter equipment should be made in maintenance shops is still in a somewhat controversial state. Here again the answer depends largely upon the size and character of the railroad in question. In most cases the number, kind and types of machines and tools to be maintained will dictate the location, size and extent of shop facilities to be provided. On roads where

there is sufficient work to justify the expense, it appears best to provide facilities and equipment for the complete overhauling of the various tools and machines, including the reconditioning of various parts, rather than to resort to contract work.

Well lighted buildings should be provided, adequate in size to accommodate the various shop tools and facilities. There should be ample floor space to accommodate the tools and machines to be repaired at any given time. Facilities for the shelter of machines repaired or awaiting repairs should not be overlooked, for exposing machines to the elements is one of the major causes for rapid deterioration.

When given the proper tools and facilities, our repairmen have generally proved themselves capable of handling this class of work, namely, reconditioning, as skillfully and more expediently than outside mechanics. The original investment in a well equipped roadway equipment repair shop may seem considerable, but it has been found to be justified on most roads because of the savings made, for even the most efficient workmen can achieve maximum production only when properly equipped.

On the other hand, roads which have few machines are not justified in making this expenditure because the small amount of work necessary to maintain their equipment does not show a large enough saving to counterbalance the expenditure. When this is the case, the only alternatives are to delegate repairs to another department or to contract repair work, unsatisfactory though this may be.

Records of Performance

Of necessity, some record of the performance of all machines must be kept if one is to determine whether they are losing or earning money. This much is agreed. However, the means of making such determination varies. What appears to be an adequate method is one which depends largely on performance tests. Paper work done by operators is generally inaccurate and a burden to them. This can be eliminated largely by (1) tests which are run in the shop and are analyzed by equipment built for that purpose, or (2), by cost tests run on the job over what is considered to be a representative period. The data obtained by either or both of these methods, combined with the records of repair costs and delays show the overall efficiency of any specific machine in dollars and cents. This method is of great importance in determining the obsolescence of machines.

This age of ours is not static. Changes are occurring with amazing rapidity in all phases of human activity. This is equally true of our railway maintenance methods. New machines are constantly being designed to meet our problems. When these new machines become available, we must of necessity adopt them when the saving which they will show make their purchase desirable. To keep up with these changes and determine obsolescence, records must be available. It is not to be forgotten that obsolescence is a word carrying far different connotations today than it did a year ago. The exigencies of wartime will be of great influence in determining the feasibility of retiring machines at this time, as will the normal considerations previously outlined. Only by balancing these factors can a satisfactory solution be reached.

Future Maintenance of Machines

Uppermost in the minds of all is the necessity for winning the war. Until that is done, little can be expected in the way of expanding the scope of track work done by machines. But when that time comes, it is evident that mechanical ingenuity, not brawn, will be the general means of securing better track construction and maintenance, for which this group is responsible. Within the last few years we have seen the accentuated growth of this trend, restricted only by the war. We can note an increasing preference for off-track machines, the possibilities of which we have only begun to explore. It is safe to say that improvements in machines and a continuing increase in their use are limited only by the future of the American railroads.

We must be prepared for the machine maintenance problems which will inevitably follow from this increased use of machines. This report has presented a means of coping with the problem, both as it stands today and as anticipated tomorrow. The structure of any organization of this nature should be such that it may be incorporated into any given system without undue expense, and yet be sufficiently versatile so that future increased demands can be met with minimum effort and maximum efficiency. The organization should be capable of indefinite expansion without any impairment of the basic design or decrease in its efficiency. These features, we feel, are incorporated in the structure which your committee has outlined in this report.

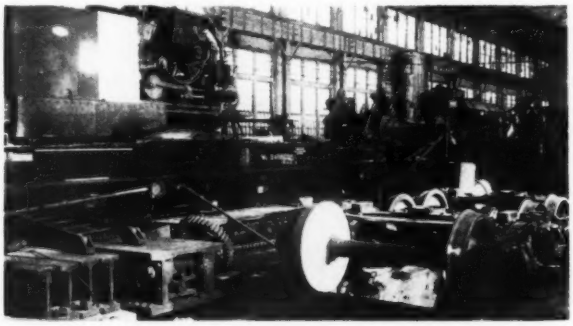
Conclusions

The importance of the proper maintenance of roadway equipment has been thoroughly appreciated by most railway officers, but in some instances they have been handicapped by outdated or clumsy organizations which are hold-overs from the days when steam equipment was all we had. A general survey indicates that many roads have modernized their organizations along lines fundamentally the same, though tailored for their particular needs. Generally, on those roads having many units of equipment, it has been found best to make shop repairs to roadway machines in a shop or shops independent of those used for maintaining operating equipment. Repairs to heavy equipment coming under MCB rules usually should be made in mechanical department shops.

The organization is generally headed by a system supervisor as a means for placing responsibility for the selection of new machines, their allocation and their proper maintenance. Working under his jurisdiction are the various maintenance shops, whether system, division, or regional. From these shops work the field machine maintainers, whose duty it is to handle all field repairs and to instruct the machine operators.

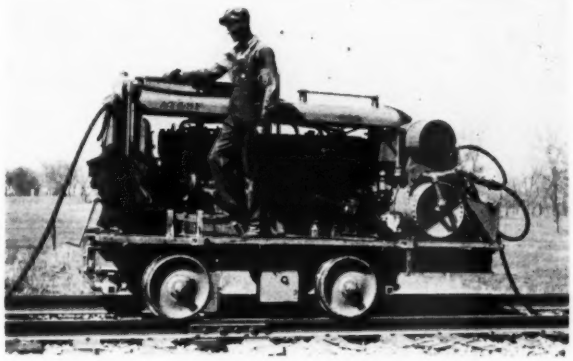
In administering a system of this nature, it has been the experience of many officers that the following points should be given special attention:

(1) The activities of the organization in charge of the maintenance of machines are a part of and should be closely co-ordinated with the work



Some Roads Prefer to Overhaul Their Heavy Maintenance Equipment in Their Mechanical Department Shops

of the local maintenance of way and structures department. However, it is important to leave the supervision of the use of the machines which have been allocated to a particular region or division to the supervisory officer of the maintenance of way department for that particular territory.



The Importance of the Proper Training of Operators Cannot Be Over-Emphasized

Once the system supervisor has assigned a machine, the actual work of the tool should not be subject to undue interference on his part.

(2) The proper education of machine operators in the care and operation of their machines should not be slighted. Lubrication and cleanliness of equipment should be stressed.

(3) Field machine maintainers, as well as the shops, should be equipped with adequate supplies of tools, well designed for their work.

(4) Power-driven units designed for specific operations, such as cylinder reborers, valve refacers, drill-presses, welding, cutting and blacksmithing equipment, suitable jigs, lathes, electrical testing devices and power grinders, have effected substantial savings when installed in maintenance shops, first in time saved, and second, in efficient and intelligently applied work.

(5) Records should be kept which indicate the soundness of continuing the use of machines. Much onerous bookkeeping may be avoided by resorting to performance tests. These, when studied in conjunction with cost reports of repairs and delays, suffice to furnish the desired information with a minimum expenditure.

(6) Since the war has thrown our economic system out of balance and thereby made the acquisition of new machines and replacement parts difficult or impossible, efficient maintenance of the equipment now in our possession has become doubly important. That factor alone justifies expenditures for the maintenance of machines which formerly might have been regarded as impractical.

(7) The greatly expanded use of roadway machines, both on and off-track, is anticipated upon the termination of the war. This trend will also demand expanded facilities for their maintenance. Therefore, your committee believes that those roads which have not as yet created or modernized their organizations should immediately take the matter in hand, despite the press of war-time business.

Your committee wishes to point out again that efficient performance on the job is the ultimate aim of good management in its consideration of roadway machine maintenance. The immediate aim is always to get as much work from the machine at as little cost as possible, with the ultimate end in view of keeping our track and structures up to par with the smallest total expenditure. Any substantial deviation from this fundamental precept violates the principles of good management and impairs our war effort.

Committee—Ray Marshall (chairman), rdm., G. N., Superior, Wis.; J. B. Akers, asst. ch. engr., Sou., Washington, D.C.; M. R. Black, asst. engr., L. & N., Louisville, Ky.; W. E. Chapman, supvr., C. of Ga., Columbus, Ga.; F. A. Chinquist, dist. rdm., G. N., Crookston, Minn.; R. H. Gilkey, div. engr., C. of Ga., Savannah, Ga.; N. D. Howard, managing editor, *Railway Engineering and Maintenance*, Chicago; C. J. Jaeschke, div. engr., M. P., Little Rock, Ark.; A. J. Johnson, rdm., C. & N. W., Redfield, S.D.; L. V. Johnson, main. engr., M. St. P. & S. S. M., Minneapolis, Minn.; H. E. Kirby, asst. engr., C. & O., Richmond, Va.; A. L. Kleine, div. engr., D. & R. G. W., Salt Lake City, Utah; W. E. Kropp, supvr. m. of w. equip., L. V., Bethlehem, Pa.; G. W. Mehaffey, stud. appren., Sou., Asheville, N.C.; G. M. O'Rourke, asst. engr. m. of w., I. C., Chicago; E. L. Potarf, asst. supt., C. B. & Q., Sterling Colo.; and A. H. Whisler, asst. engr., Penna., Philadelphia, Pa.

Discussion

Pointing to the labor shortage that is now confronting the railroads, A. Chinn (Alton) said that the only way to combat its effects is to use work equipment more intensively, and that it is now more important than ever to keep such equipment in good condition. Discussing the necessity for good lubrication, he said that many machines have been severely damaged through improper lubrication. Competent operation is another important factor, he said, and emphasized this point by saying that, in his experience, new machines have been rendered completely unserviceable in less than a month as a result of improper operation.

Because the exigencies of the times are requiring that work equipment be used more intensively, N. D. Howard *(Railway Engineering and Maintenance)* emphasized the necessity for giving close attention to its proper upkeep. The use of field maintainers is a contribution toward this end, said Chairman Marshall, because, through periodic field inspections of the equipment under their jurisdiction, they are able to forestall breakdowns. E. L. Banion (A. T. & S. F.) pointed out that under present conditions there may be a tendency on the part of machine operators to hoard parts, adding that, in the absence of adequate field supervision, it may be difficult to prevent this. Continuing this thought, Mr. Chinn recited an instance in which it was found that one road had accumulated sufficient worn or damaged carburetors to last five or six years after they had been repaired and put back in service. Chairman Marshall pointed out that such occurrences can be eliminated by placing the control of repair parts in the hands of field maintainers.

At this point the discussion turned to a consideration of the question as to whether the maintenance and repair of work equipment should be placed in the hands of the mechanical department or under the jurisdiction of the maintenance of way department. The consensus was that this function should be handled by the maintenance of way department, but that it is usually necessary to turn the heavier units of equipment over to the mechanical department for repairs. The view was expressed by several members that, because of the heavy burden that is now being borne by the mechanical department in maintaining its own equipment, the tendency might be to set aside or defer work on maintenance of way work equipment.

Pointing out that, because of the situation created by the war, sufficient mechanics for adequate field supervision may not always be available, Mr. Banion suggested that it may be possible to prevent breakdowns by having machine operators submit periodic reports on the condition of their ma-

chines. Chairman Marshall pointed out that such reports do not usually cover the condition of the equipment, and that dependence for proper field inspection must be placed on qualified mechanics. Answering a question put by Mr. Banion, Chairman Marshall explained that the extent of the territory covered by individual field maintainers should be governed principally by the number of machines to be maintained.

Describing the system on his road, W. H. Sparks (C. & O.) explained that field repairs to work equipment are made by mechanics who report to the division engineers. When a particular machine is in need of heavy repairs, he said, it is sent to a central shop, being replaced in the field by a substitute unit before it is sent in.

G. R. Westcott (M. P.) appealed to roadmasters and division engineers to give equipment maintainers their firm support in the interest of keeping machines in operation. He said that an appreciation of the importance of machinery on the part of such officers will be of inestimable value in keeping it in good working order.

The Outlook for Track Materials

By W. W. Kelly

Director, Section of Materials and Equipment, ODT, Washington, D.C.

W. W. Kelly

THE American railroads have an extremely important part to play in the enormous war program of our country. Every railroad officer and employee has a duty, vitally necessary, and which must be performed without failure. Of all railroad men, I can think of none more in the front line trenches than you of the maintenance of way department. Having been in railroad work over 35 years, more than 31 of which were in engineering, construction and maintenance of way, followed by 4 years in the purchasing and stores department, I believe I know something of the needs and requirements of your department, as well as the sources of supply of those needs. My more recent work in Washington with the Office of Defense Transportation, and contacts with the War Production Board, the army, navy and other government departments, have shown me how difficult it will be to get those materials which we all feel are so necessary to enable the railroads to keep abreast with the growing transportation demands being made upon them by the war effort.

The Office of Defense Transportation was created on December 18, 1941, by executive order of the President, and is set up within the framework of the Office for Emergency Management, like most of the other war agencies. It should be understood clearly that the Office of Defense Transportation does not occupy the same position as did the Director General of Railroads during the last war. At that time, under Presidential proclamation, the director general took over the possession and control of the railroads for management and operation. The Office of Defense Transportation does not possess or manage the railroads; its functions are to guide, co-ordinate and direct them. I think, I might also say, that it is doing this with the confident hope that federal ownership and operation will not be necessary. The many statements of Mr. Eastman, director of the Office of Defense Transportation, indicate clearly that this is the end toward which he is working.

War of Transportation

With the great volume of traffic that the railroads are now handling—involving in many cases volumes of certain commodities differing widely from those handled previously—more cars and locomotives are needed. In addition, they must keep in service, in first-class condition, their present ownership of equipment. Contrasted with this problem of other departments, your problem as maintenance of way men is quite a little different. Outside of some additional plant facilities, and, in some instances, additional tracks in areas where a great number of new plants and cantonments have been constructed, your job is to keep in first-class operating condition facilities that are already in existence. To do this job successfully requires the use of a large amount of materials, the procurement of which creates a serious problem, as either the materials themselves—or the raw products from which they are made—are in direct competition with the requirements of our armed forces. Serious as the results of this competition may be, there is not one among us but who, I am sure, will say that whatever is necessary for the successful fighting of the war should have preference over all else.

We cannot overlook the fact that this is a war of production, and, as such, is dependent largely upon transportation. Raw products must be handled from the points where they are produced to the places where they are manufactured into war goods. The completed products must be transported to the places where they are needed. It is difficult to appreciate the volume of transportation required in this routine. In the case of steel, five tons of transportation are necessary in the production of one ton of finished product. Transportation facilities, therefore, must be kept in such condition that there will be no slowing down in the movement of either raw materials or finished products. Any slowing down, or bottleneck, in transportation would have very serious effects on the war program. Obviously, vast production of war materials and equipment would be of no avail if these products could not be transported to the points where and when they are needed.

Probable Shortage of Ties

I was asked to say something to you on the Outlook for Track Materials. That can be done in a very few words. The outlook is not at all optimistic. With the exception of ties and ballast, track material is made up of those materials most important to

the war effort, and in which serious shortages have already been experienced. Furthermore, there are signs that these shortages will become even more acute than at present. However, on the other side of the ledger, there appears some hope. Much experience has been gained, and programs are being formulated which, while calling for more rigid inventory control of materials, are designed to insure a more uniform and co-ordinated flow of materials to points of use.

Products of wood are becoming increasingly difficult to secure—and ties are no exception. There are several reasons why ties are involved. First of all, is labor. In the past, ties have been produced largely by local labor and small organizations. This class of labor has been gradually absorbed by the armed forces or has gone into other types of defense work, and replacements are not available. Next, is the item of transportation, not only to get the men to and from work, but to move the ties from the woods to concentration points—transportation which is generally by means of automobiles and trucks. Here the rubber shortage enters the picture. Then, too, many ties are now needed directly in the war effort, making a further demand upon the tie industry. Finally, the producers of poles and piling, and some small sawmills making lumber, are now taking the same type of stumpage that formerly went into ties. That, in general, covers the physical side of the picture.

There is, in addition, the economic side. The two important costs in the manufacture of ties are stumpage and labor. As yet, no price ceiling has been established on either of these items, while a ceiling has been placed on what can be paid for the finished product. The requirements for railroad ties approximate 50,000,000 annually, and the fact is that they are not now being produced to meet those requirements. It is apparent, therefore, that adjustments must be made so that producers will continue to furnish the ties so vital to the upkeep of the railroad tracks.

Need More Rail—But?

In the case of rails and track accessories, the railways are in direct competition with the combined programs of the army, navy and shipping, which require so much steel. Certain of the steel products required in the war effort can be rolled on the same mills as rails, tie plates and angle bars, and come from the same semi-finished product of the steel mills.

A study of new rail laid in replacements during the last 20 years discloses some interesting facts. During the 10 years 1922 to 1931, inclusive, a larger tonnage of new rail was laid in replacements by the railroads of the United States than in any other 10-year period. This was after World War I, during which war replacements were somewhat curtailed; also at a time when heavier power was being introduced, requiring heavier sections, with a corresponding increase in the weight of track accessories. During this period, 1922 to 1931, an average of 1.74 net tons of new rails were laid in replacements per million gross-ton-miles of freight traffic handled. During the 10 years 1932 to 1941, inclusive, an average of 0.87 net tons of new rails were laid in replacements per million gross-ton-miles of freight traffic. This latter average was only half the tonnage laid in the preceding 10 years. These years 1932 to 1941 were the depression years, when a smaller traffic was handled by the railroads, which, in itself, reduced somewhat the necessity for rail renewals. There was reflected also in this period the benefit of the large amounts of rail laid in the previous 10 years, as well as the effect of the general increase in rail sections. Possibly an average somewhere between the two figures just given would be nearer a correct figure as to the rail that is now absolutely required. The average for the 20-year period, 1922 to 1941, inclusive, was 1.34 net tons of new rail laid in replacement per million gross-ton-miles of freight traffic hauled.

The approved program of new replacement rail for 1942 was 1,260,000 net tons. Of this amount, it is now estimated that 1,041,655 tons will have been rolled by September 30. There were only two years—1932 and 1933—during the preceding 20 years when a smaller tonnage of new rail was laid in replacement. In two years —1935 and 1938—practically the same toniage was laid. It is apparent, therefore, that the amount of new rail to be laid in 1942 is below any average we may assume as being necessary, especially when one considers the enormous gain in traffic we are now experiencing over that of previous years.

Preliminary estimates of the amount of rail the railroads think necessary to lay during 1943 indicate a quantity somewhat less than the average for the 10-year period 1932 to 1941, inclusive, but whether that tonnage will be made available is problematical at this time. It does indicate, however, the generally good condition of track maintenance on the railroads, and that their estimates of rail replacement needs have been kept to the minimum.

The outlook for track material is, as you can see, a serious problem. I am sure that everything possible will be done to make available to the railroads what is needed to maintain them properly. It will, very likely, not be what you think is necessary, or what you would like to have. It must, of necessity, be based on how little can be used and still be certain that there will be no breakdown in vital transportation service.

No Let-up In Maintenance

Much of the results to be accomplished by the railroads depends on you men. Your efforts in your ordinary maintenance work should be directed to make sure that nothing is overlooked which would in any way result in undue wear and tear on existing facilities. Do not anticipate that a certain piece of track will soon be renewed and that you can relax a little in maintaining it, because no one can tell at this time whether materials for that particular renewal will be available. With this uncertainty, there should be absolutely no let-up in maintenance. Special emphasis should be placed on seeing that joint ties are kept properly tamped, and that all bolts—including those around switches—are properly tightened. Rail welding should be pursued vigorously to eliminate the necessity of rail renewals. Drainage conditions should not be permitted to develop which would in any way add to the problem of track maintenance.

Scrap is a vital war necessity, and has a lot to do with the outlook for track material. You have seen news releases stating that our production of steel has been, or is likely to be, somewhat curtailed because of the lack of scrap. It follows that if steel production is curtailed for any reason, the amount of material you will receive for your track may likewise be curtailed. Scrap, therefore, should become an individual problem with you. Do not let one unusable thing remain on the property under your jurisdiction. See that it gets into the scrap pile. At the same time, make sure that anything which is reclaimable is taken care of promptly in order to reduce the amount of new material that you will require. I know of no others who are in a better position than you men in the maintenance of way department to accomplish some worthwhile results along this particular line.

You men have faced many serious problems in the past, and have always come out on top. You are now confronted with a still more serious problem. Go after it hard. Treat it as your individual problem and under-

take it as your contribution to the winning of the war. Your contribution is as necessary to victory as that of our fighting forces. This war cannot be won without adequate transportation. The railroads have done, are doing, and will continue to do their share, but they must have the all-out support of men such as you. I am sure you will not let them down.

Discussion

Answering questions following his address, Mr. Kelly pointed out that the recent price ceiling placed on ties, without a ceiling on the producing costs of tie producers, is certain to affect tie production adversely unless modified. He also called attention to the regulation permitting the army to pay a premium of 10 per cent over the ceiling price set for others, a device to insure it first call on those ties available. At another point, Mr. Kelly spoke of the confusion and difficulties arising out of the regulations prohibiting the railroads from carrying a stock of lumber, to be used untreated, in excess of 60-day requirements, and a stock of timber, to be treated, in excess of 120-day requirements. He pointed out that the latter limit is impractical, since it does not allow sufficient time to season the material before treatment.

Answering a question as to the probable continuation of the large government demands for lumber and track materials, Mr. Kelly stated that he thought these demands would continue indefinitely.

D. C. Curtis (C.M. St. P.&P.) prophesied that the shortage of material will become so great that when ties are removed from main tracks it will be necessary to turn many of them over and reuse them in less important tracks; that salvaged spikes will have to be used generally; and that other track materials will be equally difficult of procurement. He recommended that maintenance officers maintain constant contact with purchasing officers to keep themselves advised of current rules and regulations concerning the materials they need, pointing out that they must have this information if requisitions are to be prepared intelligently.

Commenting on Mr. Kelly's remarks, Albert C. Mann (I.C.) thought that Mr. Kelly was a little too optimistic, and expressed as his opinion that the railways can expect far more difficulty with respect to the procurement of materials than they have experienced thus far. He cited the last lumber order—No. 208—as an example, saying that this order is greatly hampering efforts to procure both bridge timbers and ties. He evidenced no concern about topping present ceiling prices for ties, or higher ceiling prices, if necessary, to meet present conditions, if both buyer and seller agree, but he was fearful that once those prices are raised, it will be extremely difficult to ever get them down again.

Extending the Life of Rail and Fastenings

Report of Committee

J. B. Martin
Chairman

THIS is an old subject. It has been given close study and attention by maintenance men since the earliest days of the railroads. Through the years there has been constant improvement in both the design and quality of these materials until today we have the best rail and fastenings in the history of our railroads. Many have contributed to this development; this association, with its long and constant attention to maintenance problems, has had no small part in this progress.

The railroads are now faced with an unprecedented situation. Due to war conditions there are critical shortages of many classes of materials, particularly metals. There is already a shortage of rail and appurtenances and we should anticipate a still more acute shortage in the future. Facing this situation, it is our patriotic duty to conserve the rail and fastenings that are now in service and that may be installed in order that our country's war efforts may be intensified and the railroads maintained in condition to handle the war traffic expeditiously and with resulting economies in labor and materials. The responsibility is great, particularly for the men who compose this association.

We are directly responsible for the proper maintenance of the tracks and through our daily contact with conditions are fitted to determine and apply the solution for this problem. This responsibility is being met and there is evidence on every hand of intensified efforts being made to get longer life and better use from materials. These efforts will be aided by the discussions at this meeting and by serious study of its reports.

Since rail and fastenings constitute a large tonnage of steel, it is imperative that we concentrate on their use in order to determine how we can best secure the longest life from these materials. As the situation now facing us is unprecedented, we should approach the problem with an open mind and from a different point of view than in normal times.

Proper Laying the First Essential

The life and usefulness of rail and fastenings are determined largely by how well the rail is laid and conditioned on its first application. We now have more and better equipment and tools than ever before and if they are properly used they will produce more and better work than formerly was considered possible. The primary consideration of the track forces when laying rail should be quality work, combined with the lowest cost possible through the use of carefully organized forces and the utilization of suitable tools and power equipment. If the rail is not laid correctly and then properly conditioned, no amount of subsequent attention and labor will maintain it satisfactorily and insure its maximum service life.

Emphasis has been placed in the past on the speed of rail laying and

securing a large production per day. These factors are important as all of us are interested in doing our work at the lowest possible cost, but there is danger in speed if large production is secured at the expense of quality work, for the apparent low cost so secured will prove to be poor economy when increased maintenance costs and reduced rail life are taken into consideration.

Rail should be laid as early in the season as possible so that all of the refinements necessary for its protection and long service life can be taken care of before the winter season sets in. The care of rail starts when it is unloaded. This should be done with a suitable type of crane. The rail should not be dropped with force or its ends allowed to strike the ground. When unloaded, it should be in balance and set on the ground with an even bearing to prevent any possibility of its becoming bent.

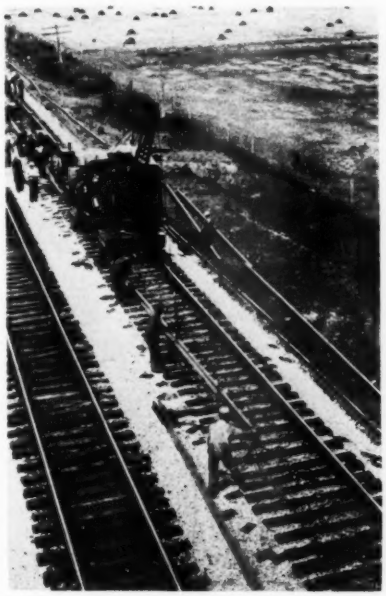
Joint Bars Require Care

The care of joints in laying is also important. The joint bars and the rail ends within the limits of the joint bars should be lubricated with either a graphite grease applied with a brush or with lubricating packing. In any case the lubricant should be of a type that will resist corrosion and permit the free movement of the rail within the bars with temperature changes. Lubricants should not be applied in advance of the laying. Pre-oiling of the rail fishing surfaces and bars permits dirt, cinders and shavings from the adzing machines to foul the fishing areas and defeats the main purpose of the oiling—freedom of movement of the rail ends in the bars.

The joint bars should be laid on the ties directly opposite the rail ends, fishing side up, immediately behind the outfit setting in the rail. Bolts should be distributed at the same time. Then, following the cleaning of the fishing surfaces of the rail, by severe brushing, and also cleaning of the fishing surfaces of the bars, as necessary, the lubricant should be applied to both rail and bars.

On railroads that encounter corrosion from brine due to brine and cinders being drawn in back of the bars by the suction created by moving trains, serious corrosion of the bars and rail within the limits of the bars has resulted. As a consequence, it has been necessary to renew considerable mileages of such rail—rail which was otherwise in good condition and would have given several years additional service life before removal. The only method of controlling this attack is to block the ends of the bars. Various methods have been tried and some benefit has been derived from all of them, but there is no unanimous opinion yet as to which is the best.

All railroads that handle refrigerator cars suffer extensive damage to rail, fastenings, tie plates and steel bridges from corrosion resulting from the brine drippings. On rail and fastenings this can be controlled economically to a considerable extent by making an out-of-face application of oil by the Neafie method. It is contended by many maintenance men that this measure is economical even where there is no brine to contend with and that the control and elimination of corrosion due to the elements produces savings much in excess of the cost of the oil application. This is true particularly in industrial territories which are subject to fog, smoke and industrial gases. A proper application requires 90 gal. of oil per mile of track. New rail should be oiled the year it is laid and annually thereafter until the rail has received four applications, after which further applications can be suspended until there is evidence of corrosion.



Rail Must Be Laid Properly To Insure Its Maximum Service Life

In the application of joint bars, it is most important to secure a proper fit of the bars and to avoid cocking of the joints. If the bars are not applied correctly or for other reasons do not fit properly, they will not support the rail ends properly and wear of both bars and rail will be accelerated. Cocked bars are serious since they cause frozen joints, and many cracked and broken bars undoubtedly result from improper application and frozen joints. When applying bars, U-shaped rods placed through the center holes and pins through the end holes of six-hole bars will bring the holes in alinement, and a good splice clamp will be found useful in bringing the bars to place correctly and avoid cocking.

On rail laying jobs, the bolts should be tightened to a uniform tension and care should be taken not to overtighten or stretch the bolts. This should have special attention if power wrenches are used. On some roads it is the practice, where power wrenches are employed, to use the high-speed drive for running up the nuts, and to do the final tightening by hand with a 36-in. wrench.

Expansion Must Be Maintained

An important factor in maintaining good joint conditions is to maintain correct expansion. The temperature of the rail should be taken with an accurate thermometer at frequent intervals during the rail laying and the thickness of the shim used should be changed in accordance with any changes in the rail temperature. The rail temperature may vary considerably from the atmospheric temperature.

Proper shims should be used. They should be exact in size—that is, a ⅛-in. shim should be exactly ⅛ in. throughout. The use of pieces of boards or keg staves should not be tolerated. A sufficient number of each size of shims should be on the job at all times. The practice of doubling up shims is not advisable. No deviation from the expansion table should be permitted. If the gap provided is too wide it will result in excessively open joints in the winter, which will cause batter of the rail ends and possibly shearing of the bolts, while if too little gap is provided it will result in tight joints in the summer and eventually in chipped rail ends and disturbed gage. When laying rail, care must be taken not to disturb the expansion gap. The rail should be set in tight to the last shim, but without bumping, for the bumping of the rail is the cause of much disturbed expansion. After the rail is laid, attention should be given to preserving even expansion.

Bolting and spiking should follow closely after the setting in of the rail and retightening of the bolts should be done before they become loose enough to disturb the expansion. The application of rail anchors should follow the spiking and bolting and should, if possible, be completed before the passage of the first train. A sufficient number of anchors should be applied to control the rail move-

ment in both directions. Do not err by applying too few.

Tie plates should be placed properly and with the shoulders parallel with the flange of the rail. The rail should have bearing on all ties and all loose ties should be tamped up to provide a solid bearing.

The tie spacing and surfacing should follow the rail laying as closely as possible. Spacing should be done accurately and according to standard plans—that is, each panel of rail should have the correct number of ties, with each in the correct position. That this can be done accurately, it is necessary to watch the centers when laying rail and not allow them to get off enough to disturb the spacing.

A Good Foundation

Rail cannot be maintained in good surface and condition without a good foundation. This requires good ties, ballast and roadbed. Where the ballast is insufficient or dirty, uneven surface and churning will develop and the rail ends and joint bars will be damaged.

When rail renewals are programmed, ballast cleaning or reballasting should be carried out a year in advance of the rail laying work in order to avoid the necessity for making a high lift on the new rail. Where a high lift is made, there will be uneven settlement for some time, with danger of damage to the new rail. The old rail should take this punishment and the new rail should be raised only enough to permit easy spacing of the ties. Following the spacing, the track should be surfaced and brought to grade, tamping all ties. Stakes should be furnished for both grade and line at this time, provided they were not furnished the previous season for the ballast renewal. A few months later, and before the end of the season, the new rail should be given a light out-of-face surface lift with thorough tamping, preferably with mechanical tampers.

Where necessary, banks should be widened and drainage conditions improved far enough in advance of the rail laying program to avoid interference. If banks are to be widened considerably and heavy material is used, this work should be done at least a year in advance of the rail program so that the final settlement will have taken place.

The renewal of ties under the old rail that is to be replaced should not be deferred so that it will become necessary to make heavy renewals under the new rail. Heavy renewals create extensive disturbance of the ballast bed and cause uneven settlement, with consequent damage to the rail. If the rail is laid on ties that are in good condition, less adzing is required and the ties will consequently furnish a more uniformly solid bearing surface for the rail.

Good and exact workmanship when rail renewals are made constitute the secret of securing extended life from rail and fastenings. With proper organization and equipment, the cost will not be greater than with a less efficient organization and indifferent workmanship.

When the out-of-pocket cost of a mile of new rail laid and conditioned is considered, any slight increase in cost occasioned by better workmanship and attention to details will be inconsequential when compared to the savings to be secured by increased life of the rail and fastenings, and the savings will be impressive when applied to the mileage of rail relaid each year.

Old Rail Must Be Maintained

Your committee has devoted considerable space in this report up to this point to pointing out desirable practices to be followed in the laying and care of rail, with the thought that if the initial installation is not properly made and cared for, damage will be done that can not be rectified later. Rail renewals are probably not made on more than 5 per cent of the main track mileage annually, so that the 95 per cent of the mileage remaining must be cared for and considered in any program of conservation.

Good workmanship and attention to details should apply not only to rail renewal work but to all work of maintenance as well, for nothing is more wasteful of material than poor workmanship. Owing to the scarcity of materials, it will be necessary to continue in service much rail that normally would be renewed. This may mean that more labor will have to be applied to such sections of track than would normally be the case, but it is one of the conditions that must be met.

Either rail of light section or old rail can be so maintained as to provide safe and comfortable riding track if the tie and ballast conditions are good. These items should receive consideration, with attention particularly to the ties under the joints. No rail or joint can be maintained satisfactorily on poor ties.

The Proper Assembly of the Joints Is One of the Most Essential Features to Long Rail Life

As the rail grows older, surfacing should be given close attention, particularly the tamping, giving special consideration to weak spots in the rail. The surfacing of old rail is neglected frequently with the thought in mind that it is not economical to expend much labor on surfacing it since it will be renewed at an early date. This attitude is questionable, even in normal times, for the rail should be useful for relayer purposes eventually and the better its condition the more useful it will be.

Since the joint is the weakest part of the rail, it is the most troublesome, but there is still much that can be done to preserve it. The rail surface at the joint can be maintained by welding and grinding. Welding has been highly developed and is being done expertly, and is generally practiced on the railroads. Welding, grinding and cross slotting of joints are adding years of life and usefulness to rail.

Joints Must Be Given Attention

Joints bars should be in good condition and when worn to the extent that they do not support the joint properly and are causing damage to the rail, they should be renewed with either reformed straight or crowned bars or new, straight, crowned or oversize bars to compensate for wear. Before programs of joint reconditioning are set up, a careful field survey should be made to determine

the condition of the joints, the amount of rail batter and wear, and the condition of the bars, so that proper methods and materials can be provided for reconditioning the joints. Some roads are building up bars in track. When joint bars are renewed, they should be applied with the same care as when laying rail.

Bolts should be kept tight and in good condition. Nothing is more damaging to joints and bars than loose bolts. Bolts should be tightened whenever they become loose, but a regular program with a definite time for tightening bolts will improve these conditions. Expansion should be watched and the proper gap maintained. Rail anchors should be in place and functioning. Slotting and beveling of the rail ends should be done frequently enough to prevent chipping.

Curves should be kept in good surface and alinement. Out-of-surface conditions or poor alinement of curves will cause unusual and uneven flange wear on the head of the rail. On sharp curves where the rail wears rapidly, increased life can be secured by transposing the rail from one side to the other. Flange oilers add much to the life of rail on sharp curves.

Any condition that contributes to poor surface or line conditions will cause damage to and undue wear of the rail. These conditions will generally be found to be unstable roadbed, insufficient or dirty ballast, poor ties, poor drainage or a combination of these, and they should be corrected so far as possible.

Need Stable Roadbed

There are various methods of correcting unstable roadbed conditions, viz; bank widening, driving old ties for support, the installation of pipe for drainage, installing French drains, placing concrete slabs and forcing concrete grout into the soft spots. French drains are being installed in many places and concrete grout is being applied in many other places. These methods have been found to be economical and effective.

With modern equipment, it is possible to clean hard ballast economically, with a decided improvement in track conditions. Much work of this character is now being done by the railroads. Foul ballast and poor drainage at street and highway crossings produce bad track conditions and result in many damaged rails if they are not corrected.

Good maintenance largely provides the answer to how to extend the life of rail and fastenings, but there is also a large field to be covered in the reclamation of materials that have been removed from tracks. Many railroads have adequate and efficient reclamation plants which are reclaiming and reconditioning track materials economically. The life of rail, frogs, switches and crossing frogs, stock rails, etc., is being extended greatly by welding and grinding in the field. Much material that has been removed from track can and is being reclaimed that would be scrapped in normal times. The cost of reclaiming alone should not be the sole determining factor, although it will usually be found to be favorable; rather, the determination of whether it is possible to secure a reclaimed item that will be as satisfactory as a new one warrants consideration.

Bolts from rail renewal jobs, that are removed by turning off the nuts with a power wrench instead of breaking or cutting them off, will be found usuable. Spikes that are not too badly corroded or throat cut can be straightened. Rail that has been removed for bad joint conditions either because of batter or corrosion, is being cropped and still has a long potential life for relayer purposes.

Tie plates can be repunched and used on other sizes of rail. Frogs, both turnout and crossing, are being built up, worn castings are being replaced, or the old ones are being shimmed and the bolts renewed. Switch points are being built up or the worn points are being cut off and made into shorter points. Rods are being straightened and then holes rebored. Plates are being straightened and built up, and longer plates, if too badly worn, can often be cut off and made into shorter ones. These are only a few examples of what can be and is being done to conserve materials. If such measures are carried out conscientiously, they will save a large amount of critical material.

Welding, Grinding and the Cross Slotting of Joints Are Adding Years of Life to Rail

Any program for conserving materials requires close supervision. Before any material is replaced today, one should determine: (1) What can be done to make it suitable to remain in track? (2) If it is necessary to renew it, what further use can it be put to?

Committee—J. B. Martin (chairman), gen'l. insp. trk., N.Y.C., Cleveland, Ohio; G. B. McClellen (vice-chairman), gen'l. rdm., T. & P., Alexandria, La.; R. W. Bonney, gen'l. rdm., Seaboard, Jacksonville, Fla.; A. E. Botts, asst. engr., m. of w., C. & O., Richmond, Va.; E. J. Brown, asst. supt., C.B. & Q., Galesburg, Ill.; P. Chicoine, retired rdm., C. P. R., Vaudreuil, Que.; A. Chinn, ch. engr., Alton, Chicago; M. H. Dick, eastern editor, *Railway Engineering and Maintenance*, New York; H. E. Durham, asst. engr., A.A.R., Chicago; A. E. Hendrix, supvr., Sou., So. Clarksville, Va.; J. B. Kelly, gen'l. rdm., M. St.P. & S.S.M., Stevens Point, Wis.; F. H. Masters, ch. engr., E.J. & E., Joliet, Ill.; J. E. Padgett, rdm., M.P., Coffeyville, Kan.; J. A. Rust, rdm., Sou., Winston-Salem, N.C.; E. J. Ryan, supvr., D. & H., Plattsburg, N.Y.; G. L. Sitton, ch. engr. m. of w. & s., Sou., Charlotte, N.C.; Lee Spencer, supvr., L.I., Jamaica, N.Y.; and E.E.R. Tratman, C. E., Wheaton, Ill.

Discussion

Answering a question by S. H. Shepley (E. J. & E.), Chairman Martin said that the committee does not recommend the use of built-up switch points in main-line turnouts. Turning to the matter of reclamation, F. G. Campbell (E. J. & E.), pointed out that, because of war conditions, economic considerations are no longer the governing factor in determining whether materials should be reclaimed for reuse. This means, he said, that costs should be largely disregarded.

Much of the discussion of this report dealt with the protection of joint bars from corrosion by oiling or joint packing. W. H. Sparks (C. & O.), said that the practice on his road is to oil the rail ends and hang the bars on them before the rail is laid, and that the bolts are tightened immediately after the rail crane has passed over the joints. He added that considerable care is given the matter of gaging to avoid kinked joints. Mr. Sparks observed that speed in laying rail is no longer considered of paramount importance; rather, he said, the primary objective is to do the work carefully and properly to the end that the maximum life will be obtained from the rail and other track materials.

Referring to the practice of oiling rail ends and joint bars before the rail is laid, Chairman Martin said it

had been the experience of some roads that the oiled surfaces become fouled with cinders and sawdust from the adzing operations, and that for this reason the practice has been abandoned in some cases.

E. L. Banion (A. T. & S. F.), expressed the opinion that there is a demand for a cut-off saw capable of cropping rails in the track. He explained that this expedient will become necessary if much of the rail now in track is to be kept in service. Chairman Martin explained that a number of saws have been developed for this purpose, but that the practice of cropping rails in track is still largely in the development stage.

Scrap—What the Illinois Central Found*

By C. M. Chumley,
Engineer Maintenance of Way,
Illinois Central, Chicago

THE routine plan on the Illinois Central for handling scrap is more or less similar to that of most roads. For example, in the maintenance of way and structures department we maintain bins at each headquarters or point where men assemble for work, and gangs doing miscellaneous track maintenance are required to bring in all second-hand and scrap materials at the close of each day's work. These materials are dumped near the bins, where in due time they are sorted by the foreman or another experienced employee with the view of separating those items suitable for further use, permitting only scrap material to go into the bins. The accumulation of scrap rail is piled near the bins and, at necessary intervals, scrap cars are sent over the road in local trains, or billed from station to station, so that the accumulation can be loaded. When the cars become loaded to capacity, or when a district has been covered, the cars are billed to the division storekeeper.

In addition to the daily or individual project cleanup, our section forces comb the entire right of way periodically. This is usually done in the early spring before the grass and weeds begin to grow. Forces engaged in work on bridges, buildings and other structures handle their scrap in about the same manner as the track forces, except that it is their usual practice to clean up upon the completion of each individual job, instead of daily.

Campaign Started

With such a plan for handling scrap, one would think that there would be little chance for any great accumulation. However, we found this far from being the case. Therefore, early in 1941, in recognition of the urgent need for scrap metal of every kind, our president issued a circular entitled "A RAILROAD NEED—A PATRIOTIC DUTY." This circular was followed up by one issued by our operating vice-president, purchasing vice-president and engineering vice-president, emphasizing the importance of collecting and marketing all available scrap. These circulars were distributed over the entire system for the purpose of stimulating and accelerating the regular routine of handling scrap. They were followed up from time to time by other circulars and letters of instructions from heads of the various departments, urging everyone to gather scrap.

C. M. Chumley

All this had a very telling effect on the amount of scrap collected, and we were pleased with the results being accomplished. However, about the latter part of the year, our vice-president in charge of purchases felt that we were not digging deep enough and that there still remained hidden sources of scrap, as well as of usable materials. Therefore, a special committee was organized under the chairmanship of the general storekeeper, its members representing the bridge, building, signal, water service, roadway equipment, forest products, locomotive and car departments. This committee was instructed to cover the entire system, working with local forces, to see that every nook and corner were searched for scrap and unused or obsolete tools and machines. Every tool, machine, or piece of unused equipment was to be studied and analyzed, and unless its prompt use or early need could be definitely foreseen, it was to be scrapped.

The committee started February 10, 1942, and the larger terminals and shops were the first to be visited. On the arrival at these points, a meeting was held with local officers and department heads to explain the purpose of the committee, great care being exercised to make the local people understand clearly that the objective was not to find fault or to criticize them for having scrap or usable materials on hand, but rather to aid them in reaching a decision as to what should be scrapped or otherwise disposed of. With this method of handling, the wholehearted cooperation of local forces was obtained immediately and the search was on.

The committee was vested with authority to decide just what material should be retained and what should go into scrap, and, under the circumstances prevailing, was more liberal to the scrap viewpoint.

Sub-committees, consisting of division officers and employees, were appointed to make a check of all roadway tool houses, extra-gang and bridge and building gang camp outfits, work shops and other storage places, with the view of turning back to the storehouses, or transferring to other points, all surplus tools and materials, as well as of scrapping those found to be worn out and obsolete. This alone proved of great value, not only in the amount of scrap turned in, but also in making available for further use many tools and a large amount of material.

As a result of this campaign, our scrap sales from August, 1941, to

*This is an abstract of Mr. Chumley's address, since the campaign for collecting scrap on the Illinois Central was described in detail in an article entitled Collecting Scrap—For Victory, in the August, 1942 issue, pages 536-540.

and including August, 1942, have included 73,313 gross tons of ferrous metals and 207 net tons of nonferrous metals. No record was kept of the amount of scrap unearthed by the committee, as it would have been difficult to differentiate between regular scrap and that turned up by the committee. However, during the period in question, the increase in scrap shipments was approximately 30 per cent over the same period of the previous year. Furthermore, the tonnage just mentioned does not include 32,120 net tons of second-hand rail furnished government projects during the same period. Under normal conditions, practically all this rail would have gone into side and yard tracks, thereby producing an equal footage of scrap rail, which would have had a very telling effect on the increase in our scrap.

The results of this intensified campaign have been very gratifying, not only from the standpoint of the amount of reusable and reclaimable items recovered, but also from that of the large amount of critical scrap gathered and made available for the country's defense effort.

We feel that the work is far from finished, so the general committee is being continued as such, and its various members, in connection with their other duties, are giving special attention to the scrap drive, and are endeavoring to keep all employees alive to its importance.

The Use of Track Grinders

Report of Committee

F. J. Herlehy
Chairman

TRACK grinders comprise those machines which are used by track forces to grind any parts of rails, frogs, or switches. The most widely used type is the flexible-shaft grinder. This unit is powered by a gasoline engine which drives a flexible shaft by belt or friction. It is mounted on small wheels or dollies or on a single wheel like a wheelbarrow, for ease in handling, and may have a guide arm to adapt it for use on the rails, with the grinder mounted over one rail and the guide arm resting on the other. The great advantage of this type unit is its adaptability to so many tasks. A straight spindle or a cup-type wheel attachment may be mounted at the end of the flexible shaft. Right angle spindles are also available where greater accuracy is required or where gouging might occur with a straight spindle. Other attachments which may be used on the ends of these flexible shafts include drills, borers, reamers and saws.

Straight wheel grinders are larger than the flexible-shaft units. They are mounted on four wheels, usually standard motor inspection car wheels, and are powered by 6- to 20-hp. engines. They are so mounted that they roll on their track wheels parallel to the rail, but also have a transverse movement on that part of the frame which carries the engine and the abrasive wheel. Most machines of this type are driven with multiple "V" belts. They use abrasive wheels ranging from 8 in. to 14 in. in diameter and from 1 in. to 2 in. in thickness. Some surface grinding machines are so built that they can be used also for cross-slotting work.

A third general type of surface grinder, usually referred to as the Precision type, is used where greater accuracy is needed or where less material is to be removed. Some of these grinders carry cup wheels and others carry a thick edge-type wheel set diagonal to the rail. This design of grinder is built to provide greater accuracy rather than production.

Uses for Grinders

The uses to which these various types of machines are put vary with the practices of individual railroads. The building up of rail ends by welding in the early days created a need for a smooth finish and the surface grinder was built to meet that demand. It is used where a sufficient number of welders are employed in the gang to keep it busy, and in other places for dressing down high welds or high heat-treated rail ends. Some roads grind their new rail shortly after it is laid to insure that the top surfaces of both rails in a joint are at the same level. Where cropped or sawed rail is used, some roads are substituting surface grinding, end hardening and cross grinding for welding. Since the low rail in such a joint will determine the life of the joint, it is just as satisfactory to grind the high rail to the level of the low ones as to build up the low rail end to the level of the high one. And, not to be overlooked, it costs less than half as much to grind, heat treat and cross grind the rail ends as to weld them.

Tolerances for run-offs should be limited to 0.003 in. per lineal inch on high-speed main tracks and to 0.005 in. per lineal inch on secondary lines with slower speeds. The grinding tolerances on rail ends should be confined to the same limits, with nothing under, to 0.010 in. over, as the working limits of the finished joints, whether the work is done by welding forces or by special grinding crews to reduce the destruction of the joint assembly and to give the trackman a joint that he can maintain.

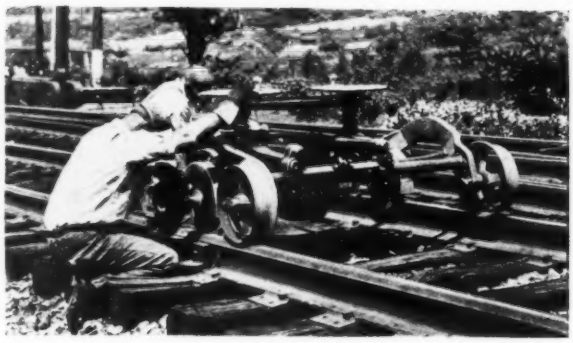
The economy of repairing frogs by welding has been demonstrated both in the field and in the shop; here again grinding machines must be used when arc welding is employed. Many frogs are so welded by gas that no grinding is required, although some railroads finish all welding work with grinders, regardless of how it is done. The grinding of a proper radius on the rail in a frog when it is welded will retard chipping for a longer period of time than where this is not done, especially where wheels cross the wing rail.

Manganese frogs require grinding to remove broken, cracked or laminated parts which fail and require welding. The grinding of a radius on the corners is even more important with manganese than with rail steel and the rule of thumb is the "Radius of the Thumb" when it comes to the grinding of manganese.

One of the more important tasks in the maintenance of switches is the grinding of stock rails and switch

points to provide better adjustment and to keep them from chipping after they flatten out. The grinding of a groove between manganese inserts and their binding rails also prevents the chipping of insert-type frogs after they have been in service for a time.

The cross grinding or slotting of rail ends is a very necessary part of grinding work, especially where the rail ends have been hardened. Many tests by individual railroads prove conclusively that cross grinding will prevent chipping.



This Surface-Type Grinder Has Wide Application in Rail End and Crossing Work

Grinding Wheels

When considering track grinding practices, the grinding or abrasive wheels should be given consideration, for they comprise a very important factor in the cost of the work. There are many sources of these wheels and any producer of wheels can make a good wheel for a specific purpose if he knows what service the wheel is to be used for. When a grinder operator has plenty of time and the volume of his work is limited by other factors, a harder or longer-life wheel with slower cutting qualities may decrease the wheel cost by as much as 25 or 30 per cent without giving rise to any increase in the cost of labor. Under other conditions, results may be improved by employing a faster cutting type of abrasive wheel and using a few more of them, with no increase in the cost of the labor used. A careful study of grinding costs may bring out other economies that are not even anticipated at the outset.

While the development of track grinders has taken place during the last 12 years, these grinders have already accomplished much and we will see more grinding in the years to come. Some railroads are grouping the various tasks of changing angle bars, tightening bolts, surface grinding, welding if necessary, and cross grinding of rail ends, into one unified program to bring joint conditions back to normal. The already heavy demand for better maintenance of tracks to meet the demands of higher speeds and heavier tonnage are now being accentuated by the movement of materials of war. We can and must give assurance to our military leaders that their materials will be moved and moved swiftly upon tracks that are maintained to proper standards.

Committee—F. J. Herlehy (chairman), rdm., C.M.St.P. & P., Milwaukee, Wis.; C. W. Baldridge, retired asst. engr., A.T. & S.F., Chicago; F. G. Campbell, asst. ch. engr., E. J. & E., Joliet, Ill.; M. D. Carothers, div. engr., Alton, Bloomington, Ill.; W. T. Elmes, rdm., P. & L. E., Pittsburgh, Pa.; J. W. Fulmer, asst. engr., Sou., Washington, D.C.; W. R. Garrett, rdm., C.B. & Q., Hannibal, Mo.; J. W. Hopkins, supvr., B. & L. E., Greenville, Pa.; W. E. Manning, supvr., Sou., Orangeburg, S. C.; F. J. Meyer, ch. engr., N.Y.O. & W., Middletown, N.Y.; R. D. Pierson, reg. engr., A.T. & S.F., Los Angeles, Cal.; J. O. Runyon, supvr., C. & O., Covington, Ky.; and A. W. Wehner, rdm., S. P., Lake Charles, La.

Discussion

R. W. Bonney (S. A. L.) stated that the grinding of stock rails and switch points to provide better adjustment and to prevent them from chipping increased the life of switch points at least 50 per cent.

C. W. Baldridge (A. T. & S. F., retired) thought that all built-up rail ends should be finished by grinding. If a flatter is used, he said, the entire rail head must be kept at a forging temperature, which takes more time and labor than grinding. The tendency when finishing rail end welds with a flatter, he pointed out, is to finish the joint slightly low to avoid excessive flatter work.

J. B. Kelly (M. St. P. & S. S. M.) asked if any members had had experience with surface grinders alone, without welding, for smoothing up rail ends. He also mentioned the hump or high spot that develops between the first and second bolt holes back of the rail ends, and suggested that building up rail ends by welding did not correct this condition and frequently left a condition near the ends of the joint bars, particularly where 24-in. joint bars are used, nearly as bad as the original battered condition of the rail ends. Mr. Kelly also suggested that the recommended tolerance for run-offs of 0.003 in. per lineal inch was small and, in many cases, would make the limits extend far from the rail ends.

C. E. Morgan (C. M. St. P & P.) said that the bolt hole hump was a common development, particularly on rail that had not been end-hardened, and that it frequently was as high as 0.030 of an inch. He explained that on his road, where the bolt hole hump was very high, it was the practice to build up the rail end to about two-thirds the height of the hump by welding, and then to use the grinder to grind off about one-third of the hump. Concerning the recommended limit of 0.003 in. per lineal inch for run-off, Mr. Morgan stated that 0.005 in. used to be the common limit for high-speed main tracks and that the limit of 0.003 in. was a more recent refinement. He added that he did not like to grind the rail surface beyond the limits of the joint bars.

Mr. Morgan also discussed the grinding of rail on double and multiple tracks where a difference in the height of the leaving and receiving ends frequently develops. He mentioned that a difference in height of 0.015 in. was not uncommon and that

The Precision Grinder Is Used Where Greater Accuracy Is Required or Where a Small Amount of Material Is to Be Removed

grinding off 0.010 in. or more of this difference would provide satisfactory service for several years and was much more economical than allowing the joint go to a difference or batter of 0.030 to 0.040 in. and then build it up by welding. In such cases, he said, an ounce of prevention is certainly worth a pound of cure. He warned that if the joint bars are to be turned, the surface grinding should be done *after* the bars are turned, rather than before, and also that before doing any work on the joint, it must be tight.

Mr. Kelly emphasized that the joint must be taken care of as well as the rail ends when the rail ends are built up and suggested that shims can be used for that purpose. He then discussed rail-end hardening and said that his experience showed that rails end-hardened in the mill soon developed secondary batter, and that better results had been obtained with rails end-hardened in the field.

Mr. Morgan replied that when end hardening was first tried on the Milwaukee they made the rail ends too hard, with the result that these ends have since had to be ground down. He added that the theoretical aim of end hardening is to bring rail ends to exactly the right hardness so that they will wear uniformly with the rest of the rail. He thought that the desirable limits of end hardness would eventually be found to lie somewhere within the range of 340-390 Brinell. He added that since the mills can end-harden rail to any hardness, mill end-hardening will be more successful when the desirable limits have been ascertained, and will save money.

Mr. Baldridge asked if it was cheaper to grind off high rail ends, as in the case of rails end-hardened too hard, than to build up battered rail ends which develop if they are too soft. Mr. Morgan replied that the ratio was about 1 to 5; that five joints can be ground for the cost of building up one by welding. President Hillman then asked whether the high ends of end-hardened rails, after being ground to surface, will remain in surface, to which Mr. Morgan replied yes, and added that apparently after rail once develops the cold rolling effect from traffic, the surface given it by grinding is pretty well maintained. For that reason, he added, it is important to delay the grinding of new rail until the cold rolling effect has developed.

The discussion then shifted to the practice of milling or grinding the stock rail to under-cut the head and box in, or house, the end of the switch point to protect it, and the question was raised as to whether this practice resulted in any damage to the stock rail. Several members told of their experience with switch points installed with special stock rails already milled to fit, and reported no damage or failures. Mr. Morgan suggested that if the grinding or milling is done in the field, care should be taken to avoid damage to the steel by overheating it, and cautioned not to leave any sharp corners.

Highway Crossing Construction and Maintenance

Report of Committee

F. E. Schaumburg
Chairman

WITH more than 231,000 highway grade crossings in the United States, a tremendous increase in the normal travel on the highways, and a greatly increased average speed of freight and passenger trains during the last few years, many problems have been added in the design, construction and maintenance of highway grade crossings. The subject has grown from one of relatively little importance to one that represents a sizeable expenditure, requiring careful design, planning and supervision. This has extended beyond the mere maintenance of a suitable crossing surface at the intersection, to include the adjustment of grades and alinement on the approaches to the crossing, the elimination of obstructions to the view, the provision of adequate drainage, suitable track construction, and the utilization of paving materials and designs adequate to the requirements of the times.

A comprehensive report on the construction of highway crossings was presented at the 1934 convention of this association and will be found on pages 102 to 123 of the proceedings for that year. That report included a discussion of the various types of crossings then in use and emphasized the importance of proper preparation of the roadbed and track prior to installation. After listing the various factors to be considered in selecting the proper type of crossing, the report presented general descriptions of several types, most of which are still in general use, including: (a) treated and untreated plank, (b) bituminous concrete, (c) preformed asphalt plank, (d) precast concrete, (e) rolled and cast metal, and (f) the rail type.

The 1934 report also included a summary of the more apparent advantages and disadvantages of several types of highway crossings; that summary is reproduced on the following page as a brief review of the work of that committee.

Since the subject of the present report is of a supplementary nature, it includes primarily a description of two new types of ready-made sectional crossings of creosoted timber, a discussion of the preparation of the roadbed and track prior to crossing installation, and a discussion of crossing maintenance practices.

Creosoted Timber Sections

The two new general designs of ready-made crossings of creosoted timber sections are designed to meet the demands of normal highway traffic and also to conform to today's railway requirements for their installation and maintenance. Completely preframed and bored prior to preservative treatment, these units may be quickly installed by small gangs; their comparatively light weight makes for easy handling; fastenings are so designed that individual sections later may be removed for any work that may be necessary on the track structure; and, in the event of grade crossing elimination, the units can be salvaged and used at other locations. Another time-

ly advantage of the creosoted timber sectional crossings is that their construction and installation require only a small quantity of critical materials, comprising the basic steel fastenings used in their assembly and construction. While the standard sectional units are designed primarily for conventional single or multiple-track crossings, special designs can be prepared to fit any type of crossing layout, including those involving turnouts and other complications.

One design of sectional crossings of creosoted timber is formed from a group of sections, each comprising three pieces of black gum timber bolted together and applied directly to the crossties with lag screws. The thickness of the sections varies with the size and height of the track rail, and the end sections are beveled as protection against dragging equipment. Wood flangeways are provided and each ready-made crossing can be installed by a small section gang without the use of special tools. Two standard sectional units are designed to pave the area between the running rails, while single units are fastened to the ends of the ties and form the paving for those areas. Creosoted black gum sectional crossings have been in service in main line tracks under heavy vehicular traffic for more than eleven years with practically no maintenance expense.

A second design of this general type crossing consists of laminated sectional units of yellow pine or Douglas fir strips placed on edge so that the edge grain of the timber forms the wearing surface. After creosote treatment, the strips are assembled with galvanized nails and the beveled end sections are protected with metal plates fastened with screws. The thickness of the units varies with the rail height and they may be fastened directly to the crossties or with intervening wood shims. Fastenings include special anchor plates, set flush with the surface, and long lag screws. A gap is provided between the anchor plates at the center line to prevent short-circuiting signal circuits. A single track crossing of this type comprises five sections in width, three of which are installed in the space between the rails and one on the outside of each running rail. Anchoring the section securely to the rails and the crossties prevents loosening and provides a crossing that is not broken or loosened by the impact or vibration of traffic.

While the untreated plank crossing is still the type that is used most extensively, its materials and form of construction are no longer suited to modern demands at busy intersections, for smooth riding, long life and low maintenance cost. All of the several types of crossings have their advocates, although some types are more widely favored than others. It is apparent that no one standard type will suffice for all railways or even for all the conditions on a single railway, for it is becoming more generally recognized that it is equally as uneconomical to install a less permanent type at an intersection subject to dense vehicular traffic as it is to place one of the more expensive types in a farm crossing. Each type of crossing has its place, just as every railway has crossings of extremes of traffic.

Drainage Is Important

The service life, ultimate economy and maintenance cost of highway crossings are determined to a considerable extent by the character of the preliminary installation work involved in the preparation of the roadbed, drainage provisions, ballasting and track renewal. Adequate drainage, the first consideration in the installation of highway crossings, usually is comparatively simple for single track crossings. In cuts, adequate culverts can be installed in the approaches on both sides of the track in conjunction with the ditches of the cuts, while if the crossing is on a fill, comparatively little additional drainage is required unless the track is on a steep grade. In such instances, it may be necessary to install drains in the approaches. At points where muddy track in the summer and heaving in the winter indicate the presence of water pockets, the condition should be investigated by adequate soundings and remedied by the installation of lateral pipe drains or French drains prior to the renewal of the crossing.

Drainage problems for multiple-track crossings are somewhat more involved and the crossing installation should be preceded by a careful survey to determine the proper drainage procedure. Poor drainage conditions or the presence of water pockets us-

Advantages and Disadvantages of Various Types of Highway Crossings

Type	*Advantages*	*Disadvantages*
Untreated Plank	Low first cost Easily removed Easy to install Can be made to fit any design of crossing	Short life due to decay Liability of plank to become loose and be caught by dragging equipment. Frequent maintenance
Treated Plank	Moderate cost Ease of installation and removal Can be adapted to any design of crossing Comparatively long life	Subject to moderate wear Moderate maintenance
Bituminous	Moderate cost Can be adapted to any design of crossing Easily repaired Will not be greatly damaged by dragging equipment Long life	Requires maintenance in patching worn areas Difficult and expensive to remove for repair of track or correction of line and surface When necessary to remove, very little can be salvaged
Asphalt Pre-formed Plank	Moderately long life Easy to install and remove Comparatively low maintenance	High first cost Rather difficult to remove without damaging
Pre-cast Concrete	Long life Low maintenance cost Can be removed and replaced without damage	High initial cost Heavy to handle
Monolithic Concrete	Long life Low maintenance cost	High first cost Expensive to remove to repair track No salvage when removed to repair track
Metal—Rolled or Cast	Long life Low maintenance cost Can be removed and replaced without damage	High initial cost Requires some attention to keep tight and noiseless Requires special fittings to make repairs when damaged
Rail type	Long life Material usually available Can be removed and replaced without much damage to materials Low maintenance	Relatively high first cost Expensive to remove and make repairs to track Cannot be handled with small force

ually require a well-planned system of longitudinal and lateral drains. In many instances it is necessary to install catch basins or sumps on each side of the crossing to catch surface water, and to provide a means of cleaning the drains. Perforated drains of 6-in. or 8-in. corrugated iron pipe are used extensively, although double-strength farm tile may be used successfully outside of the crossing limits. If feasible, the drainage system should be connected to a sewer system, and in all cases connecting culvert pipes should be installed to carry the water a sufficient distance from the roadbed.

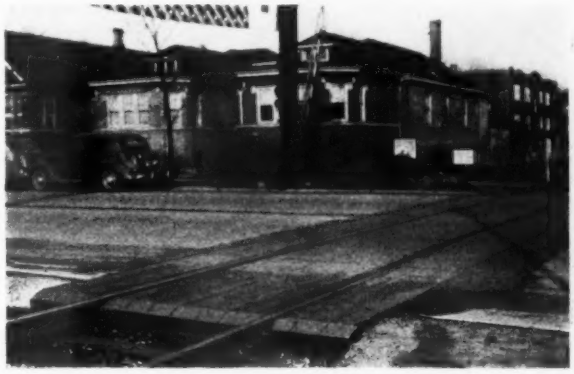
If, for economic reasons, an elaborate drainage system cannot be installed, some relief may be obtained by placing slotted 5-in. scrap superheater flues at each end of the ties on each track and usually four or five inches below the bottom of the ties. It is usually advisable to ship the flues directly to the site, where they can be slotted and welded to the proper lengths at comparatively small cost.

Ballast, Ties and Rails

If the track is not well ballasted or if the ballast is foul, it should be removed and replaced with a minimum depth of two feet of new ballast below the bottoms of the ties and extending not less than two feet beyond the ends of the ties and to the first rail joint each way from the crossing. If a yielding subgrade is present, the depth of ballast should be increased accordingly, and in some instances a sub-ballast material, such as good clean cinders, will assist in stabilizing the entire structure. Crushed stone ballast of ½ in. to 1¾ in. size, slag of ½ in. and under, and prepared gravel of good quality, all have been used successfully for crossing work. The preparation of the subgrade should include a slight slope from the center of the crossing for drainage purposes. All except sound treated ties throughout the crossing should be renewed, preferably with sawn ties of treated hardwood. Sawn ties are particularly important in assuring even bearings for crossings of the sectional or slab types.

It is desirable to renew all rails and fastenings throughout the crossing with new materials. In the event that this is impracticable and worn rail is in place, replacement should be made with good quality relay rail. Replacement should include rail of the section which is standard for that district. The rails should be so placed as to eliminate rail joints within the crossing and with the joints not less than one-half rail length from the crossing. If the length through this area is in excess of the rail lengths available, rails should be welded together to form continuous rails of the desired lengths. Rails should be double spiked to perfect line and the track should be thoroughly tamped. After sufficient railway traffic has settled the track in place, it is desirable to utilize power-driven tampers for the final tamping in order to attain more uniform results than are possible with hand tamping methods.

The final grade through the crossing should be established only after due consideration of any possible grade changes in the near future. If grade changes are anticipated, the crossing should be adjusted to the proposed elevation.



This Creosoted Black Gum Sectional Crossing Employs Four Sections, Each Including Three Timbers

Highway Approaches

Approaches to the crossing should be given careful consideration. If practicable, they should be level for the entire width of the right-of-way, and, in any event, for a sufficient distance back from the outside tracks to permit the longest truck and trailer to stop on a level grade clear of the crossing. Level highway approaches also will minimize the impact of heavily-loaded trucks, which, in turn, prolongs the service life of the crossing and reduces maintenance expense. In some instances the grade of the highway approaches is fixed by local or state highway departments, but in the case of steep approaches co-operative efforts should be made to reduce the grade as much as possible in order to reduce the attendant hazards at these intersections. When the crossing is located on a railway curve, a vertical curve may be necessary in the highway approaches to provide a smooth-riding crossing and to compensate for superelevation in the track. At multiple-track crossings, the inside track should be at the lowest elevation and each of the adjacent tracks should be raised sufficiently to provide a smooth, unbroken surface over all tracks. In instances where the highway is crowned, the approaches to the crossing should be leveled off well in advance of the intersection so that the contour will conform to that of the crossing.

Where the highway paving is of concrete, care should be exercised to insure adequate expansion strips between the crossing and the pavement to prevent excessive expansion of the pavement from pushing the track out of line and thus creating a derailment hazard. On gravel highways, crossing approaches should be paved with bituminous material in order to prevent the erosive action of loose gravel carried to the crossing by vehicular traffic or washed down by surface water. Such deposits usually induce excessive wear on all types of crossings, promote the rapid disintegration of bituminous crossings and also present a derailment hazard by filling the flangeways.

Since it is desirable to carry on the installation work with as little interference as possible to railway traffic, plans should be carefully laid to take advantage of the longer intervals between trains for the heavier work, such as removing old ballast, preparing the roadbed, installing drains, reballasting, and renewing ties, rails and fastenings. On multiple-track lines it is sometimes practicable to divert some, if not all, rail traffic during sufficient intervals to carry out the heavier operations. In either case, rail traffic over the work should be resumed as soon as possible; it is of benefit in settling the track on the new bed prior to laying the crossing.

It is desirable to divert highway traffic especially during the installation of drains, reballasting, and tie and rail renewals in order to attain uniform line and surface. Highway authorities usually will co-operate in this respect and furnish detour signs and barricades. If traffic cannot be diverted, the work must be restricted to half of the crossing at a time.

Regardless of the type of crossing, its proper and adequate maintenance

is of considerable importance. While several of the more permanent types have a long service life and ordinarily require little maintenance, periodic inspections should be made and any undesirable conditions should be corrected immediately to protect the crossing and to insure its safety and smooth-riding qualities. Good drainage, as well as good line and surface, are necessary at all times, not only within the crossing limits but also within the immediate vicinity, to prevent damage to the crossing and to insure smooth track. Low spots should be remedied as soon as possible to prevent their progressive development.

The drains should be inspected periodically and when necessary should be thoroughly cleaned to insure their proper functioning. If wet or muddy spots develop, the condition should be remedied as soon as possible by removing the objectionable material and replacing it with clean ballast. Winter heaving, common at some crossings every winter, should be watched closely and shims should be applied where necessary and adjusted as required.

Clean flangeways also are essential. Sand, gravel, dirt and other foreign materials will fill the openings, regardless of the type of flangeway and the class of pavement on the approaches, unless the flangeways are cleaned periodically. The flangeways should be kept free from snow and ice, and the entire crossing area and approaches should be cleared after every snow storm. This practice will help prevent derailments, keep the crossing dry and help prevent the packing of traffic-borne snow and ice on the crossing.

Loose crossing planks should be fastened down securely with boat spikes or lag screws applied at new locations. All broken, badly worn or rotted planks should be replaced at once in order to eliminate progressive disintegration of the crossing. Cracks in monolithic concrete crossings should be repaired at the earliest possible moment by the application of hot tar or similar material. High spots in the concrete adjacent to the running rails are subject to damage from wheel flanges or treads and should be lowered before the damage extends to larger areas. Since monolithic concrete crossings are solid and rigid, the track at each end should be kept well tamped at all times to eliminate the breaking of rails or damage to the concrete.

Where bituminous crossings are in place, or where the approaches have been paved with this material, immediate attention should be given to patching any small hole which develops, for any spot which begins to disintegrate will grow very rapidly. If the original surface has settled and become compacted to an elevation lower than that of the running or flangeway rails or planks, more bituminous material should be added to bring the surface up to the proper elevation. All patching should be carried out in accordance with the manufacturers' instructions for the preparation of the surface and the application of materials.

Slab crossings of concrete, metal or wood, which require perfectly flat bases, should be watched closely and tested frequently for teetering sections. If any are found they should be removed at once and the bearings readjusted to provide a firm foundation. In the case of cracked concrete slabs, the cracks should be filled with hot tar to prevent further checking or cracking and to keep water or frost from further damaging the slab. Loose sections in metal slab crossings cause considerable wear and should be tightened as soon as possible.

Committee—F. E. Schaumburg (chairman), rdm., C. & N. W., West Chicago, Ill.; L. M. Denny (vice-chairman), supvr., N. Y. C., Indianapolis, Ind.; E. L. Banion, rdm., A. T. & S. F., Topeka, Kan.; C. M. Burpee, man. editor, Railway Engineering and Maintenance Cyclopedia, Chicago; C. F. Edwards, asst. div. engr., C. & O., Columbus, Ohio; G. L. Griggs, rdm., C. B. & Q., Ottumwa, Ia.; J. C. Houston, supvr., N. Y. C., Kalamazoo, Mich.; J. C. Jacobs, supvr., I. C., Decatur, Ill.; J. T. Killian, supvr., Sou., Knoxville, Tenn.; H. C. Koch, rdm., Belt Railway of Chicago, Chicago; P. L. Koehler, div. engr., C. & O., Ashland, Ky.; R. C. Matthews, div. engr., A. T. & S. F., Slaton, Tex.; I. W. McPherson, rdm., M. St. P. & S. S. M., Dresser, Wis.; G. P. Palmer, engr. mtce. & const., B. & O. C. T., Chicago; G. K. Sterling, rdm., C. & N. W., Eagle Grove, Ia.; F. W. Tomlinson, Jr., sect. engr., Penna., Far Rockaway, L.I.; T. N. Turner, rdm., M. P., Newport, Ark.; J. S. Vreeland, assoc. editor, *Railway Engineering and Maintenance*, Chicago; and F. G. Walter, asst. engr., I. C., Chicago.

Discussion

In reply to several inquiries, Chairman Schaumburg stated that on his road, monolithic concrete crossings are confined to low-speed main tracks carrying freight traffic only, and to industrial and other sidings. In the construction of such crossings, he said that it is the practice to enclose the ties fully and to keep the wearing surface of the concrete from ⅛ in. to ¼ in. below the top of the running rail. He stated that crossings of this type sometimes develop small cracks, but that they give little or no trouble if they are filled with a hot bituminous filler. He also suggested that quick-setting cement be used in the construction of such crossings, and that all traffic be kept off them for at least 12 hours.

R. W. Bonney (S. A. L.) stated that in bituminous crossings it is frequently difficult to keep the material next to the rail from disintegrating, and that to overcome this tendency it is the practice on his road to use plank as a buffer and as a dam for the flangeway. According to E. E. Crowley (D. & H.), that road also makes it a practice to use a wood flangeway. Mr. Crowley stressed the importance of rolling the bituminous material during construction to compress and solidify it; otherwise, he said, it will not stand up. Chairman Schaumburg recommended that the material be placed in relatively thin layers and that each layer be well compacted. Mr. Bonney then called attention to the importance of having the track tamped solidly before the crossing is installed.

E. L. Banion (A. T. & S. F. suggested the desirability of using wood-

Laminated Sectional Crossings of This Type Are Generally Constructed of Treated Yellow Pine or Douglas Fir

plank crossing construction at points where motor-car setoffs are located, to permit heavily loaded motor cars to be set off the track without endangering the men. Chairman Schaumburg explained that on the Chicago & North Western it is the practice to plank the track at motor-car setoffs, that the planking is kept one inch below the top of the rail, and that the planked area is long enough so that the men do not need to step off the plank while turning the car. He also said that his road employs second-hand bridge ties for constructing runways from the track. Mr. Crowley stated that the Delaware & Hudson provides each gang with a motor-car turntable, which permits the lowering of the planking to a level below the rims of car and locomotive wheel-flanges.

J. B. Kelly (M. St. P. & S. S. M.) stated that his road does not permit a permanent filling of any kind between the rails at motor car set-offs, and that the gangs use portable sections of plank laid in the track to get the cars off, the plank sections being removed from the track and stored alongside when not in use.

During the remainder of the discussion it was brought out that the track should be fully planked at setoffs, because loose material between the rails presents a serious hazard. It was also emphasized that bituminous material is not satisfactory for this purpose, because it is cut by the flanges of the motor car wheels.

Recent Developments in Tamping Practices

Report of Committee

THE word "recent," as used in the subject selected for this report, is defined as "Pertaining to time not long past; modern; new or present usage." The committee has not considered its assignment to include a description and review of obsolete tamping tools and practices, and has confined its report for the most part to new or present general tamping practices in use on representative railroads.

The proper tamping of ballast is one of the most important items in the maintenance of sharp line and surface, and is essential to the economical maintenance of any track. In the past, tamping practices varied widely on different roads and to some extent between sections or divisions of the same road, as influenced by custom and conditions, including the type of ballast, height of raise, tools available, and the character of subgrade and the work being performed. It is proper that some variation still exists but, with the increasing use of power tools, the trend is toward more uniform practices on nearly all lines.

A. B. Chaney
Chairman

Power Tampers

Power tampers have been in use for many years, but in recent years many improvements have been made in the earlier machines. The weights of power plants and tools have been greatly reduced by improved and more compact designs; operating efficiency has been increased and both power plants and tools are more dependable than formerly.

Pneumatic, mechanical and electric-powered tampers have rapidly come into more general use in recent years, and the development of the lighter portable power plants, tools and self-contained units has made it practicable to replace hand tamping on spot work to an extent that was not feasible with the heavier equipment of earlier days. The adoption of off-track, crawler, pneumatic tired and other portable power plants has greatly increased the amount of productive work in tamping operations and the scope of the economic use of power tampers.

In the earlier types much time was used in moving power plants and lines; breakdowns were frequent; and with inadequate controls, tamping blows would often "hump" the track and pulverize the ballast. These disadvantages have largely been overcome in the present-day equipment. Power plants mounted on skids, pneumatic tired wheels and crawler treads eliminate the necessity for making movements on the track, the use of expensive and cumbersome set-offs and long power lines. Power plants that can be moved along with the work reduce the length of power lines and in many instances avoid the necessity for taking track out of service during tamping operations. The trend for some time has been towards the use of portable off-track machines and these types are proving their value during today's war-time traffic.

The most critical trackman can select from a wide variety of machines and tools the one best adapted to his particular requirements. There are piston and vibrating types, using air and electric power, and also direct-blow self-contained mechanical units. The vibrating type tampers are considered very satisfactory in soft ballast and for out-of-face work with relatively high lifts, while piston and direct blow tampers are generally favored in hard ballast that is not easily pulverized. The self-contained unit tampers are preferred for spot tamping and are commonly used by section and small maintenance gangs. The absence of an auxiliary power plant makes the self-contained unit tamper especially favored for spot work with small gangs. The direct blow tamper is very effective in compacting ballast where there is no general track raise.

The use of storage batteries with self-contained units involves some disadvantages as such batteries require recharging and must be moved along with the machine. The use of magneto ignition with this type of tamper is reported to give satisfactory results on some roads, while others insist that further improvements are needed. A few report that both types give satisfactory results.

Tamping Bars and Blades

In tamping bars and blades there are many types to choose from that will meet any real or fancied condition. The faces vary from ⅜ in. to 1½ in. in thickness and from 3 in. to 9 in. in width with varying shapes.

The ¾-in. by 3½-in. plain face and ⅝-in. by 5-in. toothed face are preferred by most trackmen for use in stone ballast. In tamping gravel ballast the ¾-in. by 6-in. blade or the ¾-in. by 5-in. toothed face bar is favored. For such soft ballast as engine cinders, chats or screenings, and for the preliminary raise of high lifts, the ¾-in. by 9-in. blades are sometimes used. Step-out blades are effective for spot tamping and when working in cementing material. Step-out blades are gaining in popularity. On raises of 3 in. and over, the larger faced tools are preferred, while for spot work and final tamping of finishing lifts of 2 in. or less, the smaller faced tools are generally better.

For such special uses as breaking up fouled and cementing material, the use of cribbing forks and digging blades is recommended by many. The change from one type of blade or bar to another with modern tampers is readily accomplished without difficulty and with little loss of time.

Power Ballasters

The power ballaster is used for heavy out-of-face work and is considered most effective where the track is skeletonized, where the ties are renewed ahead of ballast distribution, and where the raise is 2½ in. or more. With these machines, which are not as widely used as other and lighter types of power tampers, uniform work is obtained by equalizing the distribution of ballast and striking the same number of blows with their tamping shoes in each crib. For raises of 3 in., the cribs should be about half full after the track is raised to grade. Shovelers working each side of the machine check the amount of ballast in the crib being tamped. After about three blows, the ballast is usually down to the bottom of the tie and additional material must then be added so that ballast will be forced under the tie, and prevent the tamping shoes from going under the tie. As a rule, six to eight blows are required in each crib, the correct number being determined by making frequent checks of the ties already tamped. When a tie is struck by the tamping shoe, the machine is moved back and a sufficient number of blows struck on the other side of the tie to straighten it up to level bearing under the rail. The power ballaster occupies the track while operating and delays on heavy-traffic lines are serious unless the track is taken out of service during work hours.

One of the most important developments in tamping practice in recent years is the increasing use of light portable and self-contained units for spot tamping by section and small maintenance gangs. From two to four units are customarily used on this class of work and the reports, almost without exception, indicate that the results have been satisfactory. These units, as a rule, are used with gangs of four to ten men. They are most effective in tightening ballast under ties where the ballast condition is good and no general raise is necessary. The following gang is used on this class of work by one road and may be considered typical of gangs used on other lines:

1 Foreman.
4 Men on tampers.
3 Men renewing ties, raising low places and jacking.
1 Man filling for tampers.
1 Man dressing, resetting anchors and driving down spikes.

10—Total.

Under average conditions, this gang completes 600 to 800 ft. of track per eight-hour day. Another similar gang consists of six men as follows:

1 Foreman.
2 Men renewing ties and raising low places.
2 Men on tampers.
1 Man dressing, resetting anchors and driving down high spikes.

6—Total.

This gang is reported as completing 300 to 500 ft. of track per eight-hour day under normal conditions.

On smaller gangs, all men are used in the preparatory work, such as raising low joints, renewing ties, etc., and then follow with the tamping and dressing. A gang consisting of a foreman and three men can use two tamping units to good advantage in raising low joints, tie renewals and spot work.

The use of power tampers permits the tightening and compacting of ballast under ties with a smaller track lift than when hand tamping is used, with the result that less ballast is used. The self-contained unit tampers are proving very satisfactory for this class of track work as power plants must be used and moved with other types of machines. Spot tampers are being used to an increasing extent to tamp within the restricted areas in and around crossings, switches and interlockers. Power tamping is faster and holds up better at such locations.

Out-of-Face Work

In out-of-face work with lifts of three inches or more, the first or preliminary tamping can be performed with shovels, forks, bars or power tampers using wide faced tools. After being settled by traffic, the final raise of two inches or less should be tamped with power tampers or picks, using the smaller faced tools.

On out-of-face tamping, power tampers are usually worked four units to the tie, tamping opposite sides or faces of the tie simultaneously on each side of the rail from the end of the tie to about 16 in. inside of the rail. Particular care must be given to tamping under the rail bearing, and the tamping must be sufficient to fill completely all spaces and voids under the tie with ballast material to uniform compactness. With eight unit machines, the leading four units tamp alternate ties so that the units will not have to pass one another in moving from tie to tie. Where 16 tampers are being used, each set of four tamps every fourth tie for the same reason. Tamping each side of the tie inside and outside the rail is commonly termed 8-face tamping and is favored where hard ballast is used.

Four-face or cross-tamping has given satisfactory results with some types of soft or fine ballast, such as chats, screenings and small aggregate gravel. This method involves tamping four faces—one face of the tie inside and outside of the rail, with both units tamping under the rail bearing simultaneously. This meth-

Surfacing Through a Switch With Electric Power Tampers

od, while used extensively, is not as popular as eight-face tamping. In coarse ballast, four-face tamping does not hold up as well as eight-face tamping and there is a tendency for the untamped side of the tie to settle more than the tamped side.

In raising track out of face, 8 to 12 jacks, set vertical and opposite in pairs, may be used to obtain a good surface and uniform tamping.

After a tie is sufficiently tamped, further and continued tamping is harmful and a waste in that material is displaced and shoved from the tie bed, or the rail is "humped." This is one of the principal conditions a foreman must watch and avoid. Particular care must be taken to avoid striking the corners of ties with tamping tools. Unless this is avoided, the bottoms of ties will become rounded, with a resultant reduction in their effective service life. This is too often the experience in rock ballast at locations requiring frequent tamping and where picks are used. The bar or blade of power tampers should be placed below the tie before tilting and tamping under the tie.

A 20- to 24-in. section in the center of the tie should be filled and tamped very lightly to prevent center-bound track.

With many trackmen, the practice of making the first or preliminary raise to within one inch of final grade, filling in and tamping with shovels and then using power tampers on the final raise, is preferred. For high raises of three inches and more in stone ballast, the preliminary tamping can be done with forks or shovels about as rapidly as by any other method. Vibrating tampers also do good work on first lifts. Cross tamping is generally satisfactory on preliminary raises, but eight-face tamping is preferred on the final lift.

One road reports satisfactory work in ¾-in. to 1½-in. crushed granite ballast, using eight tamping units with the following gang set-up:

1 Foreman supervising and handling level board.
1 Assistant foreman—surfacing.
1 Man attending machines and handling cable and hose.
8 Men operating tamper units.
2 Men with ballast forks, feeding tampers as needed.
2 Men handling jacks.
4 Men inserting and spacing ties.
3 Men spiking new ties and adjusting ballast.
1 Man—utility—water.
2 Men adjusting ballast ahead of tampers.

25—Total.

The track is cribbed out and new ballast unloaded ahead of the tamping gang by section forces. The track is given a 2-in. raise on new ballast, and the daily average of work completed was 914 track feet by a gang using piston-type tampers and 956 track feet by a gang provided with vibrating type tampers. Gangs were provided with nine tamping units each, one unit being a reserve unit.

Hand Tamping

Hand tamping, using the proper tools, has given, and no doubt will continue to give, good results under a variety of conditions. With longer sections and a growing scarcity of labor, the power tamper has established itself as an efficient and economical machine. The organization of a tamping operation and the selection of men to operate tampers are important factors. Men of the same or nearly equal skill and stamina should be paired. As there is less variation in machines than in men, it is evident that more uniform tamping can be done with power tampers than by using hand methods. Supervision is necessary with either method to see that tools are handled properly; that voids are not left under ties, and that there is no over-tamping. It is equally as necessary to provide good picks and shovels as it is to keep power tampers in good repair, if good workmanship is to be obtained. A good hand-tamped job is preferred to a poor job of machine tamping, but where there is proper supervision, there is no reason for a poor job by any method.

On most roads, the use of the shovel handle to tamp dirt track is still considered satisfactory. The use of power tampers in soft ballast, such as engine cinders, on lines where train speeds do not exceed 25 m.p.h., is not recommended or economical.

For spot work and light raises, some roads make use of the end tamping or "saw blade" method. The tool used is made from band saw steel, and is usually ⅛ in. in thickness, 5¼ in. wide and 36 in. long. A second-hand No. 2 shovel handle is attached by riveting. The advantage claimed for this method is that the material is placed on the old undisturbed tie bed for almost the entire length of the blade, extending to more than a foot inside the rail. The practice on one road covering this method is briefly described as follows:

(1) The foreman and one man with a track level first go over the track to be worked and mark it up for saw blading. The rail with the best surface is used for sighting and the amount of lift required is indicated by the track level. The amount of lift required to restore surface is marked on the outside of the rail head over each tie, making use of symbols to indicate ⅛ in., ¼ in., ½ in., etc. Usually, enough track is marked in advance for at least a half day's work, and it is considered a good plan to mark the locations of jack holes at the same time.

(2) One man follows, removing the ballast from the ends of the ties that have been marked, leaving the ballast thus removed in piles for convenient loading on the blade when the track is raised. Jack holes are dug almost to the bottom of the ties so that the foot of the jack will not force material under adjacent ties. Jacks are set not more than 8 or 10 ties apart, and it is better to raise oftener and not too high.

(3) Spikes are driven down ahead of the track raising.

(4) When the marking has been completed, the gang with the jacks and the saw blades start lifting the track and placing the ballast according to marks. The track may be raised about 1½ in. and the material placed by sliding the loaded blade under the raised tie from the end. The blade is removed with a snap-like motion so that all of the material is left in place and none is retained on the blade. The blade is loaded in accordance with the marking and size of the tie to be tamped.

(5) If the material is dry and loose and runs under the ties easily, the

Light, Readily Portable Power Units Are Available For Either General Surfacing Or Spot Work

track should be lifted only slightly higher than the final grade. In such cases more than one load may have to be placed as the end of the tie often plows off part of the material as the blade is being inserted under the tie. It is necessary that the space be practically filled if the final grade is to be within ¼ in. to ⅜ in. of the lift.

When using this method in stone ballast, it is desirable to use ¼-in. to ½-in. screenings for tamping material. The "saw blade" method is relatively new, but during the period from 1930 to 1939 when sections were lengthened on nearly all roads, it gained many new adherents.

Crawler-Mounted Tie Tamper Compressors Save Much Time Lost Formerly In Moving On-Track Equipment

Skill Is Essential

Skill is the most important factor in obtaining good tamping, whether it is done by hand or machine. It is essential that each tie be tamped tightly and the ballast compacted uniformly for best results. Unfortunately, the use of power tampers is accompanied by considerable noise and it is necessary to keep a close watch for approaching trains. This is especially true in curve territory. On small gangs, the foreman usually assumes responsibility for the look-out duties, but in the larger gangs it is advisable to assign a man to this duty when tampers are operating. While it is apart from this subject specifically, the filling in and dressing of ballast should follow the final tamping closely in order not to lose any of the benefits of good tamping.

A tie should be tamped to the extent necessary to bring it firmly against the base of the rail without "humping" the rail. Many reports indicate that power or machine-tamped track holds up as much as 50 per cent better than hand tamping.

Tampers, like other items of equipment, require repairs, replacement of parts and good care to keep them serviceable. This deserves special emphasis in these days for, because of the war effort, replacements and repair parts are increasingly difficult to obtain. It is highly important, therefore, to give tamping equipment the best possible care to avoid breakage and to conserve cables and other appurtenances in order to keep it in satisfactory operating condition. Many gangs find it economical to assign a man specifically to look after tamping equipment and insure that it is being properly handled and lubricated and protected from damage when not in use. Frequent checking and inspection of tamping equipment by repairmen and those charged with that duty is recommended as good practice at any time, and as a conservation effort for the duration.

The trend for some time has been from hand to power or machine tamping. The reason is that the machine can be made to do better work at less cost when all factors are considered. Furthermore, with heavier loads and higher speeds, the track requires more tamping than it did two decades ago. For present traffic it is necessary that ballast be kept tight against the bottoms of the ties for satisfactory riding conditions, and this is accomplished only by tamping. Greater care is now being exercised by all track men to insure tighter tamping and less dependence is being placed on traffic tamping to assist in compacting the ballast bed. It is now the rule to do the best possible job of tamping, letting later traffic tamping add its additional benefit. It is still good practice to go back over a piece of finished track two to four weeks after completion and spot-tamp any ties that have settled or that were not tamped completely.

The principal recent trends and developments in tamping practices may be summarized as follows:

(1) Increasing use of power tampers, replacing hand work.

(2) Greater use of light power tampers for spot work.

(3) More uniform tamping practice on all roads.

(4) Lighter lifts and more thorough and tighter tamping.

(5) Greater care in the distribution of ballast and in the preparation of the track ahead of tamping.

(6) The development of power ballasters.

(7) The development of more suitable tamping bars and blades.

(8) The development of off-track power plants and lighter equipment.

(9) Less dependence on traffic tamping.

With the urgent necessity for considering man-power for the war effort, the increasing maintenance tasks and growing scarcity of good track labor, your committee is impressed with the necessity for making maximum use of tamping equipment whenever and wherever such use increases productive effort and conserves man hours for other essential purposes.

Self-Contained Unit Tampers Are Being Used Widely for Spot Tamping by Section and Small Maintenance Gangs

Committee—A. B. Chaney (chairman), dist. engr., M.P., Little Rock, Ark.; W. H. Sparks (vice-chairman), gen'l. insp. trk., C. & O., Russell, Ky.; M. D. Clark, engr. m. of w., P. & N., and D. & S., Charlotte, N.C.; A. J. Dillard, rdm., A. T. & S. F., Dodge City, Kan.; E. L. Farmer, rdm., St. L. S. W., Lewisville, Ark.; R. L. Fox, rdm., Sou., Alexandria, Va.; C. M. Hayes, gen'l. rdm., M. St. P. & S. S. M., Minneapolis, Minn.; W. L. D. Johnston, supvr., Sou.,

Shelby, N.C.; T. F. King, rdm., Sou., Asheville, N.C.; R. W. Lucas, rdm., C. R. I. & P., Manly, Ia.; F. H. McKenney, dist. engr. m.w., C. B. & Q., Omaha, Neb.; R. E. Meyer, rdm., C. & N. W., Mason City, Ia.; E. C. Mingus, rdm., C. R. I. & P., Topeka, Kan.; P. F. Muller, rdm., C. & W. I., Chicago; R. E. Noonan, asst. rdm., B.-R.I., Tomball, Tex.; Wm. O'Brien, supvr., P. M., Toledo, Ohio; W. F. Smock, supvr., Sou., Somerset, Ky.; and T. L. Williamson, rdm., S. P., Winnemucca, Nev.

Discussion

Armstrong Chinn (Alton) pointed out that section gangs spend approximately 60 per cent of their time tamping track, and added that for this reason substantial economies can be effected by using power tampers. He went on to say that the effect of traffic on the track is proportional to the square of the speed; hence, in these days of high speeds, it is important to maintain tracks in good line and surface. Mr. Chinn asked whether it is customary to make provision for "spelling off" tamper operators because of the strenuous nature of the work. In answering this question, Chairman Chaney said that the extent to which such men become fatigued depends upon the amount of rest they obtain during interruptions due to passing trains. Ordinarily, he said, such interruptions are such that the operators need not be given additional rest periods.

At this point a lengthy discussion took place regarding the relative merits of using multiple jacks when surfacing track. W. O. Frame (C. B. & Q.) started this phase of the discussion by citing certain objections to this practice. W. H. Sparks (C. & O.) said that it is the practice on his road to carry out surfacing work with gangs of 25 to 30 men, using six to eight jacks, and moving the rear jacks forward as the work progresses to loosen up the track ahead of the raising operation. He said that where the raise is from 1½ in. to 2½ in., the tamping is done with power tools, but that where it is 3 in. to 5 in., shovels are used. C. C. Pelley (I. C.) pointed out that one important advantage of using multiple jacks is that it reduces the amount of track that must be tamped when building run-offs to permit trains to pass. Mr. Chinn added that it also gives the rail more uniform support when it is being tamped. Describing the disadvantages of using multiple jacks, Mr. Frame said that the jacks interfere with the spacing of ties and make it impossible to slide the jacks forward on the rail.

Describing the practice on his road, R. W. Bonney (S.A.L.) said that surfacing gangs consist of 30 to 56 men, the actual number depending upon the amount of dressing to be done, and that 24 jacks are used by each gang. These gangs raise track without the benefit of speed restrictions. Such gangs, he said, can give track a 6-in. raise at the rate of 1,600 to 1,700 ft. a day, or about 24 ft. per man-hour.

Referring to that part of the report which describes the organization and output of the 10-man gang engaged in spot tamping, using self-contained portable tamping units, G. R. Westcott (M. P.) asked how much track a gang of this size could be expected to tamp in one day, using hand methods. Answering this question, P. F. Muller (C. & W. I.) estimated that the output would be 300 to 400 ft. daily, or about one-half that which could be expected if power tampers are used.

The Control of Injuries Under Today's Changing Conditions

Report of Committee

YOUR committee feels that this subject is more important at the present time than ever before. This was indicated clearly by the promptness of the response made by each member of the committee to the request for information for inclusion in this report. The suggestions offered by each member were valuable in the preparation of the report and it was interesting to note in their replies the uniformity of practices now in effect on the different railroads throughout our country for the prevention of injuries.

It is realized by your committee that, during the present emergency, injuries should be eliminated so far as possible. The railroads, as well as other industries, are now confronted with a serious labor shortage and each man permanently injured or killed on a railroad must necessarily be replaced by some able-bodied man who could otherwise serve effectively in the Nation's armed forces or in essential war industries.

Owing to the heavy demand for men in our armed forces, we are unable to exercise the same discrimination in selecting maintenance of way men that we have practiced in normal times, and it is obvious that it will be necessary to accept men beyond the age limits previously established and also probably to relax to some extent our physical requirements and accept men who are less efficient in safety practices. Nevertheless, as far as possible, when employing men, we should still give consideration to their education, physical condition and their ability to adapt themselves to the work.

S. J. Hale
Chairman

Intelligent Supervision

Injuries can be controlled by safety education. Intelligent supervision is the keynote for the prevention of personal injuries. Safety as it pertains to track men has declined to a level far below that of previous years. There is, therefore, field for improvement today.

Years ago, track men were considered the least skilled of railway labor. The majority of the laborers were uneducated, and no great effort was made by the foreman or supervisor to educate them. Today, the track man is fairly well educated, many having a high school education. Their ability and skill in their department compare favorably with

those of employees in the mechanical department or in train and engine service.

The track foreman in those days was looked upon as a mere "section boss." In fact, a foreman was never selected for that position because of his desirable qualities or for his ability to lead and educate the men under him, but he was picked in consideration of his long years of service and his ability to handle a few men. It seems as though this nickname of the track foreman has lost its meaning, for today he is looked up to with much favor, as one who can lead the men that are working under him, and as one who possesses the qualities necessary to teach and educate them.

Foreman Plays Important Part

In this age of modern railroading, the foreman should be selected for those qualities that fit him to be a leader and teacher of his men—first, his own education; second, his ability and honest ambition to acquire further education; and, third, his ability to educate the employees under his supervision.

It is particularly evident that good judgment and careful supervision on the part of the foreman are necessary if accidents are to be avoided. To be successful in accident prevention, the foreman must be sincerely interested in the safety of his men. His interest, in turn, will be in direct proportion to the interest shown by his roadmaster and superintendent. Of course, no foreman is really indifferent to the safety of his men; yet we know that some foremen have frequent accidents while *others* facing the same conditions and exposures have practically none, and we wonder why. Sometimes this may be due to a difference in ability, but more frequently it is due to a difference in the mental attitude toward safety. One foreman is determined that no avoidable accidents shall occur and acts accordingly, while the other foreman is more interested in getting the work done than in the safety of his force, so he gets the work done and hopes for the best. Experience has proved clearly that the right kind of foreman can get the work done and also protect his men.

Owing to our inability to secure men today who measure up to our normal standards, and the great increase in the amount of traffic, it is far more essential that foremen and supervisors devote more time and exercise greater care in instructing these less efficient men in safety practices than ever before. This has been illustrated clearly by the serious accidents that have occurred in various parts of the country within the last few months.

Reward and Discipline

Some railroads have found it benecial to offer their foremen some extra incentive for a good safety performance, such as giving certificates and a letter for a good record. We think this is desirable where it can be properly arranged. On the other hand, some discipline is often necessary for safety rule violations or lax supervision, the penalty assessed depending on the seriousness of the offense. In minor cases, the offender should be shown his mistake and taught how to avoid it in the future. In more serious offenses some discipline should be applied or the foreman given a letter of reprimand, either to be filed with his record. Where frequent infraction of the rules by an employee results in accidents or injuries, and after every possible means of safety education has been used and failed, the employee should be dismissed from the service.

We have said much about the foreman because, in many respects, he is the real key to the accident situation. While we are sometimes inclined to complain about the accident records of certain foremen, we should pay tribute to maintenance of way foremen as a group. They have much to contend with and face emergency problems of a most trying character; yet in their safety work, as in their other work, they give the highest type of loyal, efficient and conscientious service.

Safety Education Vital

In the interest of safety education, meetings should be held by the roadmaster at regular intervals, at times and places that enable the men to attend. At these meetings the men should be free to offer suggestions that may lead to the prevention of personal injuries. The men should also have the freedom to express their thoughts when the "Rule of the Day" is being discussed in their own gangs. They should be encouraged to call attention to some unsafe employee, some unsafe practice, some rule being violated, or some rule which is inconsistent and which should be modified or cancelled. Furthermore, the men should receive the co-operation and tireless effort of their foreman and roadmaster.

The Foreman Should Never Fail to Call Attention to Unsafe Practices He May Observe Among His Men

It is true that in some localities it is difficult to hire labor with much education. In such cases, the foreman must be efficient and capable in educating the labor that is hired. To some extent it is possible to educate this class of labor in safety and in the prevention of injuries, but the foreman must be continually on the alert to supervise their work to insure that it is performed in a safe manner. Although apparent interest may be shown by this class of labor in safety performances, their effort is not always sincere. While they consider and obey the foreman's instructions in regard to each safety rule, they make very little attempt to improve their methods or to educate themselves, leaving it entirely to the foreman to educate them.

The men usually do what the foreman or supervisor wants them to do. The foreman must first educate himself before he can expect to educate the men under his supervision. A foreman who believes in breaking or violating a rule will soon find that his men will assume the same privilege. On the other hand, if the foreman abides by the rules, a fair attitude is experienced by the men under him. The foreman who is technical in defining certain rules to the detriment of safety will antagonize the

men. This will lead to disrespect of the rules and eventually a personal injury will be the result.

We have more power-driven equipment now than we had a few years back. Many of our men who have been in the service a long time received their track education when most, if not all, of these machines were unknown. The handling of these machines by the older employees should be avoided as much as possible. Younger employees who have entered the service during the last ten years are more largely of the machine age and much more machine minded.

No one feature in safety education and accident prevention is more valuable than a well-designed book of safety rules. So far as it can reasonably be done, employees should be told specifically what they should and should not do to avoid injury. Safety rules serve this purpose much more effectively than detached instructions. To be of value, however, these rules must first be thoroughly understood by the men and then firmly enforced by the supervisors. It is better not to adopt safety rules at all than to adopt them and then not enforce them.

Responsibility of Supervisor

Railroad management, from the inception of railroad history, has preached safety in various forms. Rules were made for the safeguarding of employees before there was any general demand from employees for protection. However, little progress was made by either side until the inauguration of the Safety First movement as a co-operative activity, with responsibility shared equally by management and men. It is safe to say that every safety rule that an employee is called upon to observe is in effect because someone has been injured or killed through failure to observe the instructions contained in the rule.

Today, and in the future, the safety of the employees on our railroads depends almost entirely on the willingness of supervising officers to co-operate with the management in the enforcement of safety practices. Today, we should realize as never before that we cannot spare the life of a single employee through preventable accidents.

Far too few of us think of ourselves as leaders, or, if we do, we fail to recognize the full obligation of that responsibility. The prevention of accidents is one of the most important duties of a supervising officer. It is his duty to the men working under him; it is his duty to the company that employs him; and it is his duty to himself.

Unsafe working conditions have been removed as far as possible by the management, and safe working methods have been devised. Only one other element is required, and that is *good supervision.* A supervisor should bear in mind that he has a personal responsibility in this matter and should see that foremen under his supervision are trained to work safely and are up-to-date on safety rules. His foremen should be made to understand that they are being held directly responsible for the safety of the men under their supervision.

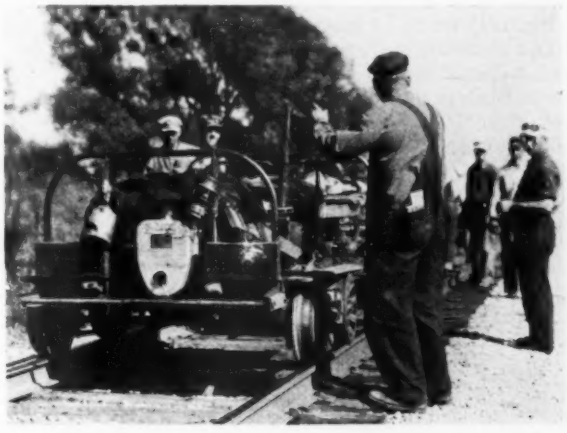
A supervisor should think of himself as a leader and not simply as a boss who gives orders and deals out discipline, to the end that a specified quota of work is turned out each day. He should also organize his foremen as leaders who will take the tried and proved methods of accident prevention that have been worked out and put them into use in solving today's special accident problems. The foreman should understand that the fact that there may be no specific rule covering some specific thing he is called on to do, constitutes an added reason why he should exercise his own common sense and good judgment concerning the safety of his men.

The foreman should be so trained that safety methods will become second nature to him. He should become so accustomed to applying safety principles to his work that his every effort will be performed in the safest manner possible.

The average workman today believes in safety insofar as the safety of himself and his fellow-workers is concerned. However, when any unusual condition arises, or when any new or unfamiliar work is assigned to him, he is justified in looking to his foreman for help and guidance. Under such conditions his foreman should be on the job to furnish such assistance and see that the work is done in the safest manner possible. In the very first contact of a foreman with a new employee, safety should be emphasized. When the new worker gets out on the job, the foreman should explain the hazards peculiar to the work and show him how to avoid them.

Investigation

To prevent accidents in the future, we should know how they have occurred in the past. Therefore, in addition to routine investigation by local officers, we should have a field man investigate all maintenance accidents which promise to yield information. This practice will prove beneficial in many ways. With prevention in view, it develops the real cause, which often lies deeper than the apparent cause, and produces material for intelligent study for remedies. It also gives the field man an excellent opportunity for valuable missionary work with both the foreman and his men, and is further utilized as an occasion for inspecting the hand tools used by the gangs. In cases where accidents continue in a gang, repeated visits of the safety representative become embarrassing for the foreman.



"Why Do Some Lines Have Good Motor Car Accident Records and Others Have Poor Ones?"

Use of Track Motor Cars

We are all familiar with track motor car operation and track motor car accidents, as well as with the precautions which should be taken to prevent them, and it is not necessary for your committee to stress this feature. Practically all railroads have approximately the same motor car rules. Why do some lines have good motor car accident records and

others have poor ones? This is probably the result of difference in enforcement. If we expect to prevent motor car accidents, we must enforce the rules. We think the secret of track motor car accident prevention is in currently observing the conduct of motor car operators, through advice, warning, and punishment if necessary, to check careless tendencies and rule volations before something happens.

The cranks of motor cars should be attached permanently. The cars should be provided with safety railings, tool trays, footboards and wheel guards. These safeguards, together with a well-designed standard coupling between the motor car and trailer, should do much to reduce motor car casualties. One feature which requires constant attention is the safe piling of tools on motor cars. All motor cars should approach grade crossings at a restricted speed and be prepared to stop short of obstructions. If motor cars approach grade crossings so that a positive stop can be made before entering the crossing, there is little likelihood of the motor car operator failing to see an approaching vehicle, striking it or being struck by it. Men travelling to and from work on trailers pulled by motor cars should be highly supervised. The men must be seated and instructed not to engage in conversation while traveling, as this may detract the operator's attention from his duties. The foreman and his men should keep a constant lookout in both directions, watching for obstructions and train movements. Care must be exercised in moving through interlocking switches, remote control switches and station platforms. Rules should be strictly complied with in these cases. Lineups should always be obtained before the cars are placed on main lines. Cars must stop or greatly reduce speed when trains are moving on adjacent tracks.

Many auxiliary attachments that add to the safe operation of motor cars have been developed from time to time, such as non-derailing attachments, proper seats, safe footrests, extension lift bars and the like. The operations involved in setting motor cars on and off track are prolific producers of such injuries as sprains, strains, hernias, crushed hands and feet and fractures. Such injuries indicate not only a lack of instructions in the proper position for lifting, but also that sufficient attention has not been given to the design of proper lifting bars.

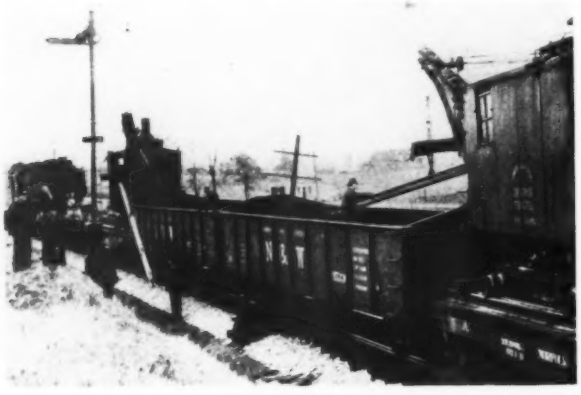
Safety rules and safeguards are necessary for the safe operation of motor cars, but of still greater importance is the matter of safe men to operate them, which still leaves us with the all-important duty to see that those who operate motor cars are properly instructed, trained and supervised to operate their cars in a safe manner.

Handling Rail

On the average railroad, the handling of rail causes more maintenance of way accidents than any other one operation. Rail and frogs should be handled by a crane, magnet or other power equipment. In the heavier sections, frogs weigh so much that it is impossible to handle them safely by hand. No attempt should be made to lift a rail until it is completely free from the other rails in the car and the boom has been centered directly over it to prevent it from jumping or swinging sideways. The safest and most efficient way to handle rail to and from cars by derrick is to arrange the rails in even tiers in low-side gondola cars, placing at least three wood strips between the tiers. The rails should all be upright. This requires more time and care when loading, but is amply repaid by the greater safety and speed in unloading.

No attempt should be made to lift a rail while a train is passing on an adjacent track. Men should not be permitted to jump over a rail suspended under a derrick or to pass under it, and all rails should, of course, be center-marked for tongs. Tongs, cables and fastenings should be examined by the foreman and roadmaster frequently to detect wear or defects, and the operator of the power hoist should be held strictly responsible for the condition of all apparatus belonging to the hoist.

When setting rail between tracks where the ballast is troughed, the rail should be turned on its side to prevent its shifting and possibly fouling an adjacent track because of vibration of passing trains. Rails, frogs and switch material should be placed as near as possible to the point where they will be used in order to reduce the hazard of re-handling them by hand. Where rail is to be handled by hand, such as when loading it on pole or push cars for short movements, the roadmaster should provide in advance plenty of men to handle it. The men should be spaced at the ends, leaving the middle of the rail clear to rest on the car. All movements of push cars loaded with rail should be at a very slow speed and men should not ride on a push car loaded with rail.



"On the Average Railroad, the Handling of Rail Causes More Maintenance of Way Accidents Than Any Other One Operation"

Miscellaneous Suggestions

Improve maintenance of way hand tools. Each hammer or chisel, or other tool from which steel flies and strikes an employee, should be sent in to the test department for analysis to determine whether it is of proper temper and in safe condition for use. When tools with overflowed edges or improper chamfer are found, the superintendent's attention should be called to that fact so that he can handle the matter with his people, with a view to keeping these tools in safe condition for use.

Prohibit the driving of claw bars under spike heads except when absolutely necessary.

Prohibit the dropping of rail by hand to break it.

Require the use of a sledge hammer rather than a spiking maul for striking cutting and backing-out tools.

Require employees assisting in unloading materials through drop-bottom cars, which require bumping or jarring to dislodge them, to get off the car before the bumping is done.

Prohibit the pushing of trailer cars ahead of motor cars.

"Require Employees to Clear Both Tracks in Double-Track Territory When a Train Is Passing on Either One of Them"

Define specifically the way in which motor cars and other gasoline engines are to be cranked.

Require employees to clear both tracks in double-track territory when a train is passing on either one of them.

Goggles should be worn for any task requiring their use. The foreman should see that goggles are available for his men and that they are worn by them when required. The wearing of safety shoes should be encouraged by the foreman. Every man should wear safety shoes on the job as they have prevented many injured toes.

Require foremen to read the line-up of train movements to his men so that all of them may be informed of trains and of the move to be made.

A safety representative, accompanied by suitable division supervisors, should go over the division on a motor car at suitable intervals to talk to maintenance of way gangs about safety and to examine their tools, motor cars, etc., for defects.

Turning rail with lining bars has caused many head or other injuries. This should be prohibited and a short tool such as a track wrench or tool especially designed for this purpose should be used.

Jacks should be set securely before using. Proper jack handles should be used, and the handles removed when the jacks are not being operated.

When unloading ballast or similar material from hopper cars, all concerned should have a clear understanding of what is to be done and everyone should be in the clear before the latches are knocked loose and the doors dropped.

Repairing and cleaning machinery while in motion should be prohibited. If driven by an individual motor, the motor should also be stopped before performing such work. Oiling machinery while in motion should be avoided so far as practicable.

Committee—S. J. Hale (chairman), asst. supt., N. & W., Bluefield, W. Va.; W. E. Chapman (vice-chairman), supvr., C. of Ga., Columbus, Ga.; N. F. Alberts, gen. foreman, C. M. St. P. & P., Chicago; J. F. Beaver, supvr., Sou., Durham, N.C.; A. L. Campbell, rdm., S. P., Alturas, Cal.; F. L. Etchison, gen. rdm., A. C. L., Rocky Mount, N.C.; H. C. Fox, supvr., Sou., Spartanburg, S.C.; G. J. Giles, supvr., L. & N., Harlan, Ky.; J. G. Gilley, div. engr., C. & O., Richmond, Va.; C. Halverson, rdm., G. N., Grand Forks, N.D.; G. S. King, supvr., Sou., Chester, S.C.; J. D. Kirkland, supvr., C. R. I. & P., Topeka, Kan.; E. K. McArthur, rdm., A. & Y., Greensboro, S.C.; W. C. McCormick, rdm., S. A. L., Savannah, Ga.; J. M. Miller, div. engr., W. M., Cumberland, Md.; D. V. O'Connell, rdm., C. & N. W., Chicago; V. P. Shepardson, rdm., T. C. I. & R. R., Ensley, Ala.; and G. E. Stewart, rdm., S. P., Merced, Cal.

Discussion

The discussion of this report dealt initially with the suggestion in the report that the pushing of trailer cars ahead of motor cars be prohibited. F. G. Campbell (E. J. & E.) expressed the opinion that this rule would be difficult to enforce in all cases, and asserted that safety rules that cannot be enforced should be liberalized.

A. Chinn (Alton) expressed the view that this report is particularly timely because of the need for conserving man-power in view of the present shortage of labor. He advocated the careful reading of the report by all those who are in responsible charge of work. Referring to the sentence in the report which reads: "The foreman should be so trained that safety methods will become second nature to him," Mr. Chinn said that this statement constitutes the "meat" of the entire report, but implied that it applies not only to foremen, but to all other employees as well. He also said that employees must be so trained in safe methods that they will do the safe thing automatically and added that the man who has a complete realization of danger at all times rarely is involved in accidents.

At this point the discussion turned to a consideration of safe methods of starting motor cars. It developed that it is a rather general practice among the employees of some railroads to start motor car engines by turning the flywheel against compression, a practice which sometimes results in injuries. E. L. Banion (A. T. & S. F.) said that it was not always possible to start motor cars with a crank because some are direct-connected, and went on to say that the mechanical improvements that have been made in motor cars in recent years have to a large extent eliminated the hazards involved in starting them. He expressed the opinion that motor cars can be started safely by pushing them if all rules governing this practice are observed. Mr. Chinn said that in all his experience with motor cars he had never known one to kick when cranked, if the spark was properly retarded.

The entire burden in preventing accidents should not be placed on the section foreman, according to W. H. Sparks (C. & O.) It was his idea that every man in the organization has a part to play in preventing accidents, and that for this reason safety programs must be designed to reach every employee. He said that this can be done most effectively by bringing home to the employee the realization of his responsibility to his home and family. It is extremely important, he said, that the section gang should not leave the tool house in the morning without an accurate line-up of trains, and that the line-up should be read aloud to the men by the foreman.

At this point Mr. Chinn described two accidents, each involving the death of a track foreman, which occurred under almost identical circumstances. In both cases the accidents were attributable to the improper loading of tools on motor cars. In each instance the lining bar was so placed in the tool tray that it projected over the forward edge of the tray, in which position it gradually worked forward until it became unbalanced. Seeing that the bar was about to fall, the foreman in each case reached downward to retrieve it, but in both instances he was too late. Caught under the arm by the bar as its upper end was thrown forward by the movement of the car, the foreman was hurled on to the track in front of the car, with the result that in each of these instances he was injured fatally.

W. O. Frame (C. B. & Q.) said that if he were to add anything to the report, he would dwell more at length on safety education. Pointing out that maintenance of way work is highly seasonal and involves numerous unrelated tasks, he said that it is not to be expected that maintenance of way employees will be able to memorize all of the safety rules that have been developed to govern all of their activities. Through proper safety education, he said that it should be possible to teach employees the safety habit so that they will not need consciously to recall the safety rules governing specific tasks. The practice of taking up a rule a day is a good one, he said, provided that the rule that is considered on any given day deals with some phase of the work that is to be performed during that day.

R. M. Blackburn
President

H. C. Hickey
President-Elect

Lewis Thomas
Secretary-Treasurer

Track Supply Association Holds Constructive Exhibit

FOLLOWING the policy established in 1884, of presenting an exhibit at every meeting of the Roadmasters' Association, and carried out without a break, except in 1893 and 1904, under the auspices of the Track Supply Association, 45 manufacturers of materials and equipment used in the construction and maintenance of tracks, presented exhibits of their products, requiring 63 exhibit spaces for their display. Three of these companies had not previously presented exhibits at the annual meetings of the Roadmasters' Association.

During all these years, and particularly during the period of World War I, this exhibit has played an important part in the success of the annual meetings of the Roadmasters' Association. It has enabled maintenance administrative and supervisory officers to keep abreast of the latest developments in both materials and equipment and has been of real benefit to them in the preparation of their budgets for the ensuing year. Although the exhibit was smaller this year, because some manufacturers who have exhibited regularly through the years are now engaged largely or wholly in the production of war materials and equipment, it was of constructive value and contained a surprising variety of both materials and equipment that are still available, despite limitations imposed by priorities and other restrictions on the use of critical materials.

The officers of the Track Supply Association were, president, Ross M. Blackburn, Buda Company, Chicago; first vice-president, H. C. Hickey, The Rail Joint Company, Inc., Chicago; second vice-president, H. M. McFarlane, O. F. Jordan Co., East Chicago, Ind.; secretary-treasurer, Lewis Thomas, Q & C Company, Chicago; directors, E. C. Argust, Morden Frog & Crossing Works, Chicago (ex-officio); A. B. Hillman, Belt Railway of Chicago, Chicago (honorary); T. D. Crowley, The Creepcheck Co., Inc., Chicago; H. W. Cutshall, Electric Tamper & Equipment Co., Chicago; C. B. Armstrong, Air Reduction Sales Co., Chicago; F. A. McGonigle, Mall Tool Company, Chicago; C. O. Jenista, Barco Manufacturing Company, Chicago; and J. B. Templeton, Templeton, Kenly & Co., Chicago.

In the election of officers for the coming year, Mr. Hickey was advanced to president; Mr. McFarlane was made first vice-president; Mr. Crowley was elected second vice-president; and Mr. Thomas was re-elected secretary-treasurer. The newly elected directors are Mr. McGonigle (re-elected); L. I. Martin, Morden Frog & Crossing Works, Chicago; and H. A. Morrison, *Railway Engineering and Maintenance*, Chicago.

A list of the exhibitors, the products shown and the names of their representatives follows:

Exhibiting Members

Air Reduction Sales Company, New York—Literature—C. B. Armstrong, C. A. Daley, J. F. Franzen, J. W. Kenefic, L. C. McDowell, U. F. Portell, D. N. Newland, E. F. Turner.

American Fork & Hoe Company, Cleveland, Ohio—Rail anchors; tapered rail-joint shims; shovels; weed cutters; ballast forks; rakes; scuffle hoes; broom rakes; axes; hammers; scythes—H. C. Branahl, C. C. Connolly, S. L. Henderson, J. J. Nolan, D. L. O'Brien, Frank J. Reagan, John Skeel, R. J. Whalen.

Barco Manufacturing Company, Chicago—Gasoline tie tampers; gasoline hammer—F. N. Bard, W. J. Belhke, C. O. Jenista, W. T. Jones, C. L. Mellor.

Buda Company, Harvey, Ill.—Inspection motor car; 2-4 man inspection car; switch stand; bonding drill; track drill; track liner; rail bender; journal jacks; track jacks; hydraulic jacks; pole jacks; automatic lowering jacks; tie puller; tie nipper; light section car; track gages; track level; and nozzle tester—James B. Akers, R. M. Blackburn, H. H. Cohenour, J. S. Dempsey, R. B. Fisher, J. F. Hartley, W. H. Haas, R. K. Mangan, R. J. Mulroney, D. Richards, M. J. Rotroff, J. W. Sanford, G. A. Secor, L. O. Stratton, R. P. Williamson.

Chipman Chemical Company, Inc., Bound Brook, N. J.—Weed killer—C. M. Bernuth, N. J. Leavitt, W. H. Moyer, I. J. Strain.

Creepcheck Company, Inc., Pittsburgh, Pa.—Rail anchors—T. D. Crowley, N. A. Howell.

Crerar, Adams & Co., Chicago — Track and bonding drills; track tools; pipe wrenches; tool handles; tie, lumber and other marking crayons; air skilsaws and electric hand drills; track and switch brooms—R. W. Beasant, Geo. J. Doyle, A. Kopala, I. E. Poehler, J. M. Temple.

Cullen-Friestedt Company, Chicago—Moving pictures of Burro locomotive crane in operation; rail tongs—W. C. Bamber, K. J. Beller, L. B. Bertaux, C. J. Bronez, E. V. Cullen, F. J. Cullen, F. P. Cullen, T. G. Frazee, Robert W. Jamison, F. L. Kendig, Jos. F. Leonard, G. G. Prest, James E. Simkins, Wm. J. Roehl.

A. P. deSanno & Son., Inc., Phoenixville, Pa.—Radiac grinding wheels—N. A. Conway, Jr., Wm. Lukey, L. G. Martin, E. J. Rohan.

W. S. Dickey Clay Manufacturing Co., Kansas City, Mo., and **Robinson Clay Products Co.,** Akron, Ohio—Clay cradle invert pipe; demonstration of hydraulic characteristics of various pipes; motion pictures of typical drainage installations—H. W. DeBacher, C. M. Huckins, C. R. Scheid, W. C. Slee.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.—Track jacks; power jacks; journal jacks; automatic lowering jacks; tie spacers; tie remover—E. C. Gunther, J. F. Van Nort.

Eagle Grinding Wheel Company, Chicago—Grinding wheels—John Abrams, L. E. Buckingham, R. S. Lloyd, J. C. Rinehart.

Elastic Rail Spike Corporation, New York—Elastic rail spikes—C. M. Bernuth, A. C. Jack, B. Kuckuck, George W. Muller, A. J. Reading.

Electric Tamper & Equipment Company, Ludington, Mich.—Electric tie tampers; 4 and 8-tool power units; concrete vibrator; tamping tools; and assorted blades—H. W. Cutshall, J. F. Hensel, Raymond Hermann, G. L. Walters.

Fairmont Railway Motors, Inc., Fairmont, Minn.—Inspection car; section car; and extra-gang bridge and building car—

C. P. Benning, W. D. Brooks, Kenneth Cavins, W. G. Day, W. F. Kasper, J. T. McMahon, V. Pagett, Ralph W. Payne, G. L. Rager, W. H. Ripken, H. A. Sly, William Williamson.

Hayes Track Appliance Company, Richmond, Ind.—Literature and models of bumping post; derails and wheel stops—R. A. Downing, S. W. Hayes, Herbert J. Mayer, P. C. McClure.

George M. Hogan & Co., Chicago—One-man track tool—V. C. Cartier, J. T. Flynn, G. M. Hogan, D. L. O'Brien, Stanley H. Smith.

Illinois Malleable Iron Company, Railroad Division, Chicago—Rail anchors—Chas. G. Ericson, Dayton T. Hogg, John C. Kuhns, H. A. Morean.

O. F. Jordan Company, East Chicago, Ind.—Model and pictures of spreader ditcher and snow plow—A. W. Banton, J. C. Forbes, H. M. McFarlane, C. W. Shipley.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.—One-man inspection car; differential axle; motor-car wheels; track gage and level; and extra gang power car—H. O. Christian, Ralph E. Keller, Frank E. McAllister, G. Monroe, E. C. Poehler, P. J. Robischung.

Lundie Engineering Corporation, New York—Rail clips; tie plates; tie tongs; rail lubricator—L. B. Armstrong, O. W. Youngquist.

Maintenance Equipment Company, Chicago—Switch-point protector; rail and flange lubricator; and literature—E. Overmier, T. E. Rodman, P. A. Wells, H. V. West, P. J. Wolf.

Mall Tool Company, Chicago — Gasoline and electric rail grinders; concrete vibrators and surfacers; bridge and building machines; gasoline, electric and air-driven chain saws; gasoline and electric drills and circular saws; pneumatic circular saw; flexible-shaft grinders and polishers; sump pump—R. F. Burgwald, S. Gromnicki, J. Innes, A. W. Mall, F. A. McGonigle, M. Rhenquist.

Morden Frog & Crossing Works, Chicago—Adjustable rail braces; forged-steel braces; new saw-toothed adjustment for adjustable braces—E. C. Argust, W. Homer Hartz, G. F. Killmer, L. I. Martin, L. C. Reebs.

Murdock Manufacturing & Supply Co., Cincinnati, Ohio—Air-lock water service box and post hydrant; air valves; anti-freezing outdoor drinking fountains; drinking fountains—Thomas E. Bart.

Nordberg Manufacturing Company, Milwaukee, Wis.—Rail grinders; track power drill; power track wrench; utility rail grinders; surface grinders; precision grinders; accessories—W. E. Bugbee, C. P. Clemmens, W. W. Fitzpatrick, John Hogan, C. K. Jensch, Eugene Larson, Ralph W. Payne, F. M. Read, Stanley H. Smith, H. H. Talboys.

Oxweld Railroad Service Company, Chicago—Oxy-acetylene welding and cutting apparatus; oxygen; acetylene; carbide; rail butt welding; flame cleaning; heat-treating of rail ends; wrinkle bending pipe; angle bar straightening—Lem Adams, M. C. Beymer, G. P. Bogert, M. Burnett, Jr., W. E. Campbell, F. J. Duffie, H. V. Gigandet, E. B. Hall, Jr., F. C. Hasse, P. Hunter, Jr., R. G. Kohn, G. B. Moynahan, D. H. Pittman, J. H. Rodger, H. W. Schulze, J. C. Stephenson, F. E. Teichen, R. W. Torbert, J. E. Winslow.

P. & M. Company, Chicago—Rail anti-creepers—D. T. Hallberg, G. E. Johnson, J. E. Mahoney, W. A. Maxwell, J. J. Metzger, F. A. Preston, M. K. Ruppert.

Pettibone-Mulliken Corporation, Chicago—Automatic switch stand; switch stands; shoulder bolts—W. A. Enstrom, W. A. Flint, C. A. Johnson, James Keenan, G. J. Slibeck.

Pocket List of Railroad Officials, New York—Copies of Pocket List of Railroad Officials—B. J. Wilson.

Positive Rail Anchor Company, Chicago—Rail anchors; guard-rail plates and braces; adjustable rail braces—L. C. Ferguson, R. J. Platt.

Power Ballaster Company, Chicago—Motion pictures of power track ballaster and power track cribbing machines—W. E. Bugbee, F. H. Philbrick, Stanley H. Smith.

Q & C Company, New York—Guard-rail clamp; switch-point guard; compromise joints; derail; gaging tools; wheel stops; rail tongs; gage rods; flange-way guard; adjustable rail brace; electric switch heater—M. Iseldyke, L. E. Hassman, G. Prest, Lewis Thomas.

Rail Joint Company, Inc., The, New York—Insulated rail joints; standard joints; compromise joints; and fibre insulation—Alex Chapman, E. A. Condit, Harry C. Hickey, G. H. Larson, H. L. Lansing, J. N. Meade, R. W. Payne, Thomas Ryan, Frank Wood.

Rails Company, The, New Haven, Conn.—M. & L. track; compression track fastenings; compression screw spike; oil, switch heaters; spring spike; automatic switch lock; strip welding for building up battered rail ends—R. E. Bell, L. T. Burwell, W. A. Peck, Wayne Sullivant, J. V. Wescott.

Railway Engineering and Maintenance, Chicago—Copies of *Railway Engineering and Maintenance* and *Railway Age*—G. E. Boyd, C. M. Burpee, M. H. Dick, S. W. Hickey, N. D. Howard, Elmer T. Howson, P. D. Juraschek, F. C. Koch, H. E. McCandless, C. W. Merriken, H. A. Morrison, J. S. Vreeland.

Railway Maintenance Corporation, Pittsburgh, Pa.—RMC plastic cakes for joint lubrication; pictures of plastic joint packing; literature on ballast cleaner—R. M. Jenner, J. B. McWilliams, J. E. Mountford.

Railway Purchases and Stores, Chicago—Copies of publication—K. F. Sheeran, Edward Wray.

Railway Track-Work Company, Philadelphia, Pa.—Literature on drills, grinders and grinding wheels—A. M. Nardini, J. Roche.

Reade Manufacturing Company, Jersey City, N. J.—D. M. DeWitt, C. F. Reade, C. H. Reade.

Sperry Rail Service, Hoboken, N. J.—Examples of transverse fissures, engineburn fractures and flash butt welds; literature—J. M. Dickey, C. W. Gennet, Jr., W. P. Morrison, C. A. Stephenson.

Templeton, Kenly & Co., Ltd., Chicago—Track, bridge and journal jacks, with exclusive wheel hold-down car-retarder jacks; telephone pole jack; tie spacer; rail puller and expander; claw-bar—R. B. Hill, P. H. McManus, William Simpson, J. B. Templeton, W. B. Templeton.

U. S. Wind Engine & Pump Company, Batavia, Ill.—Float valve, pump jack, switch stands—C. E. Ward.

Woodings-Verona Tool Works and Woodings Forge & Tool Company, Verona, Pa.—Rail anchors; triflex springs—A. C. Laessig, R. J. McComb, J. M. Moore, W. H. Woodings.

Woolery Machine Company, Minneapolis, Minn.—Tie cutting machine; creosote-spray machine; weed burner—A. J. Franke, Derby Weston, H. E. Woolery.

New Book

A. W. P. A. Proceedings

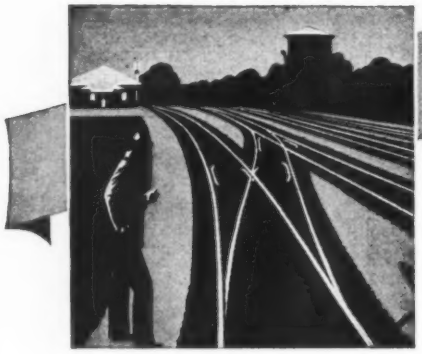
PROCEEDINGS of the American Wood-Preservers' Association for 1942. 610 pages, 6 in. by 9 in. Illustrated. Bound in cloth. Published by the Association, 1427 Eye street, N. W., Washington, D. C. Price $6.

This volume contains 42 papers and committee reports, together with the discussions that followed their presentation at the thirty-eighth annual convention at Minneapolis, Minn., in January. These reports and papers cover a wide range of subjects.

Among the reports of special interest to maintenance men are those on the fireproofing of timber; on an international termite exposure test; on service records of marine piles, posts and ties; on specifications for the pressure treatment of lumber, piles, posts and ties; and on the painting of creosoted wood.

Among the papers of special interest to maintenance men are those on Service Rendered by Various Species of Tie Timber in the Northwest, by Bernard Blum, chief engineer, Northern Pacific; Use of Gum Ties on the Missouri Pacific; by W. J. Burton, assistant to chief engineer, Missouri Pacific; Kiln Drying Southern Pine Poles, by J. G. Segelken, Bell Telephone Laboratories; Northern Pacific Test Tracks at Plains, Mont., Thompson Falls, Missoula and Lolo, by C. N. Whitney, Northern Rocky Mountain Forest and Range Experiment Station; Green salt—A New Preservative for Wood, By W. McMahon, C. M. Hill and F. C. Koch, Bell Telephone Laboratories; and A Study of Fireproofing Standards for Pressure-Treated Lumber, by L. K. Andrews, technical department, American Lumber & Treating Co.

In addition, there is also included a report on the quantity of wood treated and preservatives used in the United States in 1941, prepared by R. K. Helphenstine, Jr., a list of wood-preserving plants in the United States, Canada and Mexico, and A Review of the Lumber, Crosstie and Wood-Preserving Industry, by Grant B. Shipley, Koppers Company.



WHAT'S the Answer?

Placing Compromise Joints

Where a turnout or crossing is of heavier section than the track rails, how far back should the compromise joints be placed? Why? Will this differ where the track is signaled?

Keep One Rail Length Away

By H. F. Fifield
Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

Compromise joints should be located on the first joint back of the joint on the stock rail ahead of the points and on the first joint beyond the heel of the frog. It is generally considered not to be good maintenance practice to put compromise joints on the heel of the frog or on the stock rails. Frogs and stock rails, especially where Sampson switches are used, are considerably more expensive than straight rails and there is also the question of providing room to permit the joint on the heel of the frog to be installed and maintained properly. Compromise joints are not desirable in track and should be installed clear of the connection.

Where signals are involved, the same proceeding should be followed so far as possible. In all cases the signal department should be consulted and the location agreed upon, since there are several complications involved, such as standard locations for insulated joints.

Use Eight New Rails

By J. M. Bischoff
Office Engineer, Terminal Railroad Association, St. Louis, Mo.

Compromise joints should be installed at least one rail length beyond the wing rails of a crossing, where it is of heavier section than the track rails. The reason for this is that where the installation is made in this manner, the crossing and the abutting rails will have a full bearing on the crossing timbers with no necessity for the insertion of extra riser plates, as well as to obtain smoother-riding track. Moreover, eight new rails should always be installed to abut the crossing.

Keep Them Back

By G. P. Palmer
Engineer Maintenance and Construction, Baltimore & Ohio Chicago Terminal, Chicago

Where a crossing of heavier section than the track rails is installed, it is not good practice to place the compromise joints against the crossing or on the arm of the crossing, where an arm exists, because compromise joints tend to fail sooner than an ordinary joint, and the strain on a joint next to a crossing is usually greater than at other points in the track. Again, it is desirable that the rail adjoining a crossing be of the same section as the crossing itself, to avoid excessive wear on the crossing rails. For these reasons, the compromise joint should be placed not less than 10 ft. from the crossing, and where there are crossing arms, the section of rail adjoining the crossing should be not less than 10 ft. long before a compromise joint is installed.

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in December

1. *To what extent should maintenance forces return usable materials to the stores department for reissue, rather than hold them for local use? Does the kind or amount make any difference? What other considerations are involved?*

2. *Since severe restrictions are being placed on some classes of building materials, to what extent can second-hand materials be used for building maintenance? Where can these materials be obtained?*

3. *In view of the present shortage of both new and released rail, to what extent can a reduction be made in the rails held for emergency use out on the line?*

4. *Considering the present volume and possible delays to traffic, where an entire bent of a ballast-deck trestle requires renewal, is it preferable to re-drive it or to erect a frame bent? Why? What considerations are involved?*

5. *If the present shortage of ties increases, what measures can be taken to utilize those available to the best advantage?*

6. *Where increases in density or speed of traffic demand faster delivery of water to locomotives, how can this be accomplished without installing larger water columns?*

7. *With the growing scarcity of labor, to what extent is it advisable to provide section gangs with individual tie tampers? How many? What are the advantages? The disadvantages?*

8. *To what extent and for what purposes can cordage be substituted for wire rope in bridge and building operations?*

The same principle applies where a turnout of heavier section than the running rails is installed. In other words, the compromise joints should not be attached to the heel of the frog, but should be at least 10 ft. away. However, there may be conditions where switches of different rail sections are close together, making it necessary to place compromise joints on the heel of the frog.

Where track circuits exist, the situation becomes more complicated by reason of the necessity for installing insulated joints to avoid having a section of track through the crossing in excess of 35 ft. without track circuit protection. Because of this requirement, insulated joints must be placed close to the crossing, which necessitates moving the compromise joints farther away. In such cases, the rail between the insulated joint and the compromise joint should be full length on one side of the track, with a shorter rail on the other to provide for staggering the compromise joints. Where turnouts require track circuits, it is usually necessary to carry the section of the turnout rail some distance in all directions to permit the installation of insulated joints in both main-track and siding rails.

Where main-track crossovers exist, and the rail in one track is changed to a heavier section than that in the adjacent track, the compromise joints in the crossover must be so located as not to interfere with the necessary insulated joints. Sometimes this requires that the compromise joints be placed where they would not ordinarily be located, to avoid the use of short sections of rail, which are not desirable in main-track crossovers, especially those for high speeds.

Taking Water from Mains

Are there any advantages in locomotives taking water directly from city mains? Any disadvantages? What precautions should be observed? What maximum delivery is practicable?

No Greater Advantage

By E. M. Grime

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

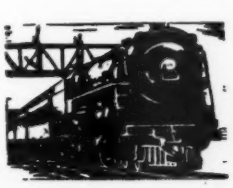
There can be no greater advantage for a locomotive to take water from a city main than from any other reliable source, but it has always been a recognized principle of the American Railway Engineering Association that where there is a reliable city water supply available, this should be used. Such use will, however, depend on the quality and the cost of the water.

It is exceptional when city water mains are of such capacity and are arranged so favorably that city water superintendents will permit the connection of a locomotive water column to take water directly from the main. Locomotive service requires a valve that will open fully quickly and that will close quickly. With such operation, considerable water hammer is likely to develop, which may cause complaints from other consumers because of damage to plumbing. For these reasons, city water men are usually reluctant to allow large-size direct city water connections for this purpose.

If the city water main is of large diameter, compared with the connection required, and the railway water column is equipped with a good pressure-relief device, the connection may work satisfactorily. This condition occurs so rarely, however, that it is usually found best to provide a storage tank of reasonable capacity where, by means of an automatic float valve shut-off, the tank is kept filled by means of a small connection with the city main. A pipe line of liberal size, at least 2 in. larger in diameter than the water column, is then provided to assure a rapid flow of water.

Under average conditions, a flow of 3,000 to 5,000 gal. per min. is required. When a flow of the required velocity to produce this delivery is stopped quickly, it is difficult to cushion the shock sufficiently to avoid water hammer effects.

About the only places where water-column connections directly from city mains work out satisfactorily are those provided for yard switch engines or at unimportant branch-line points where the water demands are not excessive and a five to ten-minute interval is of little consequence. The flow in such cases may range up to 1,000 gal. per min.



Where direct connections are practicable under the foregoing limiting conditions, there may be an attractive saving through elimination of the initial cost, as well as of maintenance, of a storage tank.

Several Disadvantages

By R. C. Bardwell

Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

About the only advantage to be gained by having locomotives take water directly from city mains, when this is permitted, is the saving in installation cost for a tank or other storage facility, or where there is no space for the location of such facilities. There are several disadvantages, however, in taking delivery to locomotives directly from city mains.

Only a few municipalities will permit connections of this kind and then only where the size of the city main and the supply are such as will prevent depressing the pressure in that locality below a point that might cause a water shortage for domestic purposes in adjacent establishments, or that might start a back-syphoning action from old toilet facilities that would cause bacterial contamination in the city water supply, when the water-column valve is opened for delivery. In addition, it is always essential that the water column or other means for delivery be equipped with a slow-closing device and a positive water-hammer eliminator, to prevent serious damage to the joints in the city mains or to the plumbing fixtures in adjacent buildings. Water hammer caused by quick valve closure on a heavy flow without a positive means for eliminating it, may extend over an area of several city blocks and result in law suits against the railway, which probably will be more expensive than any saving in the cost for suitable storage.

The maximum delivery that is practicable depends on local conditions, such as the size of the city main, other demands for water that must pass through this main and the type of delivery facilities, including the positive water-hammer eliminator. In my experience, deliveries from 250 to as high as 1,100 gal. per min. have been permitted where the facilities were suitable, with an average of from 500 to 700 gal. per min. However, a well-posted city water department will rarely give favorable consideration to heavy fluctuating demands of this character, because of

the trouble that may develop by reason of possible improper functioning of the delivery facilities.

Mentions Precautions

By J. M. Bischoff
Office Engineer, Terminal Railroad Association, St. Louis, Mo.

An advantage of delivering water directly from city mains to locomotives lies in the elimination of the usual wood or steel water tank. This will save not only the original construction expenditure for the tank, its supports and foundations, but the continuing maintenance expenditure as well. The disadvantage of such an arrangement lies in the destructive water hammer which may follow the closure of the valve, and the resultant disruption of service and renewal costs. Large water mains will not stand the shock of water hammer, while smaller mains withstand the shock better.

Where such an installation is made, the precautions to be taken include (1) the installation of a hydraulically-controlled, slow-closing valve, which reduces the water hammer; (2) insertion of an air chamber near the water column, consisting of a vertical pipe in the supply line to absorb the water hammer; and (3) maintenance to a high standard of the control valve, as water hammer will result if the valve becomes worn.

Substitutes for Cast Iron

What substitutes for cast and malleable iron can be employed satisfactorily to protect structures over tracks from the effect of locomotive blasts? What are the advantages? The disadvantages?

Only in an Emergency

By C. C. Westfall
Engineer of Bridges, Illinois Central, Chicago

Presumably, if a substitute for cast and malleable iron is sought, it is because of the present difficulty of obtaining these materials, and this same difficulty will apply to other ferrous metals. We have not made use of any of the special alloy steels that have been developed in recent years, some of which, no doubt, would be satisfactory for blast plates. We have given preference to cast iron, which seems to possess all of the necessary qualities for the purpose, and which will probably be more nearly permanent than other materials. Genuine wrought iron should be rated closely with cast iron for the purpose.

With ferrous metals out of the picture, it seems that asbestos board and lumber are the two leading, if not the only, substitutes. We have not used asbestos board for this purpose, but have one installation of creosoted-plank blast plates on an overhead bridge built by a state highway department. The objection to the use of wood, and especially of creosoted wood, is, obviously, the danger of fire, which might cause damage to the structure it is designed to protect, as well as to railway property. The disadvantage in the use of asbestos board is likely to be excessive wear where the blast conditions are very severe.

It is my belief that any material, other than ferrous metals that have satisfactory acid-resisting qualities, can be considered only as an emergency substitute. Blast plates must resist the destructive action of the locomotive gases as well as the mechanical action of the blast, the gas action being the more severe. If either the plates themselves or the bolts or hangers with which they are connected to the structure, are not resistant to the action of locomotive gases, these plates become a hazard to the traffic beneath. It is important, therefore, not only that the material from which the plates are made shall be chosen carefully, but that the details of the attachments to the structure should be worked out with this thought in mind.

Suggests Shotcrete

By J. E. Bernhardt
Bridge Engineer, Chicago & Eastern Illinois, Chicago

A covering of shotcrete over members of a structure which are subject to locomotive blasts will prove to be an exceptionally good substitute for cast and malleable iron. There is no difficulty about using this substitute on new structures, but it might be difficult to place it on an old structure. Enclosing these members in placed concrete will afford similar protection, but if this method is employed, a greater thickness of concrete is required and it is doubtful whether it will have as long life as the shotcrete, which should be very dense.

If the blast is so severe that it tends to erode the concrete or shotcrete surface, there are a number of soft materials available, which can be applied, into which cinders from the blast will be embedded and the concrete surface will be protected by this coating. Another expedient is to keep the structural steel cleaned and painted at all times with good quality paint.

Creosoted Wood Best

By General Inspector of Bridges

I consider this a timely question, aside from the evident purpose of bringing out a discussion of ways and means for conserving critical materials, for the customary designs for cast and malleable-iron blast plates are not only cumbersome but are not entirely satisfactory in some other respects, especially as regards renewal. It is not necessary to enlarge on this statement as the facts are well known to all who have had to solve this problem.

It came to my attention several years ago that untreated plank which had been attached to a creosoted-timber overhead highway bridge to afford protection from locomotive blasts was beginning to decay, and that the apparently sound wood was quite soft and spongy. In fact, it was easy to poke a small inspection timber bar through the plank. Examination showed that none of the creosoted material in the structure showed signs of either decay or sponginess. When it was suggested that the untreated blast planks be removed and replaced with creosoted material, a strong protest was raised on the ground that this would create a serious fire hazard.

In the discussion which followed, it was stated that the untreated plank had been applied to the structure in the first place as a fire-protection measure rather than as protection against the blast as such. When it was pointed out that many creosoted overhead structures have no such protection and that fire losses in them are practically negligible, a reluctant consent was given for the installation of the creosoted plank. This installation has now lasted several years longer than the untreated plank, and there have been no indications of inflammability, nor has the wood become spongy as the former plank did.

Although, in this case, the blast is not specially severe, some erosion of the wood has developed and we are

testing one or two plastic compounds that can be spread with a trowel. If this works as we hope it will, the stack screenings in the blast will become embedded in the soft material and reduce, if it does not stop, the attrition of the wood. As a result of this experience, we have applied similar construction to several permanent structures with equally satisfactory results, and I hope that it will replace our former designs for blast plates. We have found that best results are obtained from tongue and grooved material, and that the shield should be not less than about 4 ft. wide.

Added Life for Copper Valleys

What measures can be employed to prolong the life of copper valleys, gutters and flashing? Tin valleys and gutters?

Should Be Clean

By Frank R. Judd
Engineer of Buildings, Illinois Central, Chicago

In the case of copper gutters it is our practice to keep them free of cinders and other foreign matter, as such obstructions tend to collect moisture and form chemical combinations that discolor and dissolve the copper. Galvanized gutters, valleys, etc., should be kept painted whenever their condition warrants. A number of suitable materials are available.

Do Not Abuse

By Supervisor of Bridges and Buildings

Under ordinary conditions copper requires very little attention, for, while it is not as highly resistant to oxidation as some other metals, it soon acquires a coating of copper oxide or patina, which is surprisingly effective in preventing further oxidation. This patina gives the copper surface an attractive appearance, especially where considerable areas are involved, and copper roofs are sometimes admired as much for their appearance as for their lasting qualities. Of itself, tin is probably more resistant to oxidation than copper, but it does not create a protective coating for itself as copper does.

In railway service, both copper and tin are exposed to conditions far more severe than when used on residential and public buildings, although on the latter they may be subject to more neglect. The sulphurous content of locomotive gases and the sulphurous compounds that leach from locomotive cinders when moist, attack both metals with considerable violence At an isolated station the stack gases may not be particularly destructive to copper and tin metal work, but if cinders are allowed to accumulate in valleys and gutters, even in small quantities, the damage may be of real consequence, for they will soon eat through the metal sheets.

Around yards, shops and engine terminals the concentration of gases from locomotives and power plants may be quite high, compared with conditions out on the line, and the attack on exposed copper and tin may be correspondingly more severe. Similarly, there is likely to be a more rapid accumulation of cinders, and in larger quantities, so that the damage from this source will also be greater. Where oil is used as fuel the trouble with cinders is eliminated, but some oils contain more sulphur than some coals do. In any event, practically all of the sulphur in the oil is burned, while sometimes much of the sulphur in coal remains unconsumed. For these reasons, there is likely to be little difference between the two fuels, so far as the sulphurous content of their fumes is concerned.

These facts give the clue to what action should be taken to conserve the life of copper and tin gutters, valleys and other sheet-metal work. If the building is so located that there is little or no exposure to locomotive or power-plant gases, and no chance for cinders to accumulate, no action is necessary in the case of the copper or tin, except for periodic cleaning to keep them clear of leaves, dirt or other foreign matter. At the other extreme, in a busy engine terminal, the cleaning should be done at shorter intervals, in severe cases every few days. There will obviously be many intermediate gradations between these extremes, and during prolonged dry spells the cleaning need not be done so frequently, because moisture is required for the gases and the corrosive components in the cinders to attack the metals.

No material is completely permanent, and service life often depends on the attention or lack of attention it receives. Even with the best of care, which they seldom get, copper and tin valleys and gutters will fail eventually. If the exposure is severe, or where approaching failure is evident, a considerable extension of service life can be obtained by cleaning the metal and painting it with a good grade of paint. Under ordinary conditions I do not recommend this action, for it ruins the appearance of these parts of the structure. Under conditions that exist at the moment I recommend it.

Classifying Released Rail

In view of the present limitation on purchases of rail and fastenings, should there be any relaxation in existing standards when classifying rail for reuse? What are the advantages? The disadvantages?

Has Done So

By L. L. Adams
Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

In view of the present national emergency, the need for a large amount of relaying rail for defense plants and the extreme shortage of new rail, there should be a relaxation of the previous standards when classifying released rail for reuse. It will be noted that I have substituted "previous" for "existing," as it is used in the question, for we have already changed our standards for classifying rail for reuse when it is released from the track.

The sole advantage in making this change in the standards is to have rail available that can be used for defense purposes immediately, with a view to the possibility that these plants will be needed for only a few years, and any rail that is safe for use in these temporary tracks should be used, even though ordinarily it would be classified as scrap. This rail can then be reclassified as scrap when the present emergency is over. The disadvantage lies in the possible loss in labor of

renewing tracks laid with low-standard rail in the event the emergency lasts longer than present expectation.

Does Not Approve

By District Engineer

I am fully aware of the gravity of the situation with respect to steel, and the need for rail for ordnance plants, manufacturing facilities engaged in the war effort and for military camps. In fact, we have felt the pinch of inadequate supplies of both new and released rail for our own needs, as intensively as most other roads. Yet, despite this situation and the limitation now in effect on the purchase of new rail and fastenings, which would increase the supply of released rail available, I am opposed to any relaxation in our existing standards covering the classification of rail for reuse.

My reasons for this are that the present requirements for classifying released rail have been developed to their present standard through a long process of evolution, as the service demanded of rail has increased with the universal increase in the weight of locomotives and cars, and with the general increase in train speeds. At present an extraordinary traffic density has been added which, in many instances, ramifies to include what were formerly considered unimportant branch lines. On some of these lines the rail is no better than it should be and in not a few cases replacements are becoming necessary to assure uninterrupted train movement.

Section foremen, supervisors, roadmasters and division engineers are all thoroughly familiar with the present standards for classifying released rail and understand what is required of them when making an inspection. While some errors of judgment occur from time to time, these are not intended departures from the standard. When standards are relaxed, there is always more or less confusion as to what is required, and it is seldom that two persons have the same understanding about the matter. The result is that one inspector will be far more strict and another will be much more liberal than others, with many gradations between these extremes. For these reasons, when the rail is put to use, one lot of it may be of better quality than is needed, while another lot may be well below requirements; yet both will be in the same classification.

I do not mean that one should be stubborn and resist the efforts that are necessary to make the available supply of released rail go as far as possible in meeting the demands that are arising constantly by reason of increased traffic, new manufacturing plants, military camps and arsenals and the needs for replacement that are often as insistent as those for additional facilities. If the classification of the released rail is carried out in the same way as has been customary, every man involved in its use, from chief engineer to foreman, will understand and be familiar with the quality of rail available for the various projects upon which it is to be used; and there will be no confusion in the mind of any of them.

On the other hand, in view of the fact that at present inadequate supplies of released rail must be stretched to meet at least all of the important demands for military and industrial trackage, there seems to be no good reason why there cannot be a considerable reduction in the usual standards as to what rail it is permissible to use on these tracks, provided there is no compromise with safety.

Many of the tracks, even those in the most important industries and camps, will carry little traffic, and a large percentage of them will not be used after the close of the war. These tracks certainly do not need either new or No. 1 relayer rail. In fact, much of the rail that is now classed as scrap will meet all requirements on many of them. For this reason, it has been suggested that, while all of the present grades above scrap be applied as usual, the present classification for scrap be divided into usable scrap and unusable scrap, with the former term indicating that it is permissible to use the rail so classified in the less-used tracks that are most likely to be temporary.

When Applying Shellac

What method will give best results when applying shellac to new wood surfaces?

Apply in Thin Coats

By Supervisor of Bridges and Buildings

Obviously, no job can be expected to be successful unless proper preparation is made before the job is started. For this reason, the wood surface should be clean, smooth and dry. To obtain the best results, the shellac should be applied in very thin coats. To insure the correct consistency, it should be diluted with alcohol, a good grade of denatured alcohol being as satisfactory and much cheaper than the pure grain alcohol. In general, the proportions should be one part of alcohol to two parts of shellac. Another requirement for best results is that plenty of time be allowed between coats, at least three of which must be applied, and in many cases not less than six. An interval of one week is not too much.

Several Kinds of Varnish

By L. G. Byrd

Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

There are two principal kinds of varnish, spirit varnish of which shellac is the most important and which consists essentially of a resin carried in a volatile solvent, and oleoresinous varnish in which the resinous ingredients are combined with linseed oil and this compound is then dissolved in turpentine or benzine. Oleoresinous varnishes are commercially the more important and are used generally for interior finishes and similar work.

New wood surfaces can be varnished or shellacked, but to obtain satisfactory results the surfaces must be thoroughly dry. If of open grain, such as oak, chestnut or ash, they should first receive a coat of paste filler. Liquid fillers are not desirable for this purpose since they form a poor base for subsequent work. A paste filler is really a sort of paint, the pigment being silex or finely ground quartz and the vehicle is a quick-drying varnish, thinned with turpentine or benzine. This filler is rubbed strongly on the grain of the wood with a short stiff brush, and as soon as it has set, usually within a half hour, it is rubbed off with a harsh cloth or a handful of excelsior, the rubbing being hard across the grain of the wood. If it is desired to stain the wood, the oil stain may be mixed with the filler. If the wood has a close grain and needs no filler, the oil stain may be thinned to the desired color with turpentine or benzine and applied as a wash. In cleaning the filler out of the corners or recesses of moulding and other irregular surfaces, a suitable sharp stick may be used. However, no instrument that will mar or scar the surface should be employed.

If putty is necessary for stopping

nail holes or large cracks, the putty should be colored to match the wood. After two days, the first coat of varnish or shellac may be applied and after five days it should be rubbed with curled hair or fine sandpaper to remove the gloss, so that the next coat will adhere well. Then one, two or three more coats of shellac varnish should be added at intervals of five days, each coat being rubbed as described, except the last coat, which is to be rubbed to a high polish or left with its natural gloss. Outside doors, window sills, casings, jambs and all surfaces exposed to the direct rays of the sun should be varnished with spirit varnish and left glossy.

To have a satisfactorily finished job where shellace varnish is used for interior finish, at least six coats should be applied. If shellac is to be applied to floors that are to be waxed, they should receive two coats of shellac, then five or six coats of wax at intervals of one week, each coat being well polished with a weighted floor brush made specially for this purpose. Shellac itself is a good floor varnish; it will discolor the wood less than any other varnish and dries rapidly. It must be borne in mind that to obtain a satisfactory finish on woodwork, whether it be with clear or orange shellac or with any other material, the most important requirement is that the wood surface must be prepared carefully in advance of the application.

Causes of Pumping Joints

What are the causes of pumping joints? What means can be employed to overcome the trouble?

Keep Ballast Clean

By Michael J. Hanna
Private First Class, Air Forces Officer Candidate School, United States Army, Miami Beach, Fla.

Good drainage of track and roadbed is one of the most important items connected with the maintenance of good track, and the time spent in improving drainage invariably reduces the time and expense required for general track maintenance. In districts where rainfall and snowfall are heavy, where the land is marshy or where springs are numerous, drainage will require considerable attention if pumping joints are to be eliminated.

Eventually, stone or washed gravel becomes foul, no matter what efforts are made to prevent it. This may occur by reason of dust that blows in, debris that falls from cars, decaying vegetable matter in the roots of weeds that have grown in the ballast, mud that is pounded up from the roadbed and that washed in by overflowing side ditches, as well as material from numerous other sources. When the ballast becomes clogged and packed with this foreign material it will not drain rapidly or completely and the joints will begin to pump.

If pumping joints are numerous or occur in long stretches of track, the whole section of track involved should be given a general ballast cleaning, with special attention to that around the joints. Here the ballast should be dug down to at least 6 in. below the bottom of the ties, then backfilled with clean ballast. The ballast on the shoulders should be cleaned to a depth of 12 in., or down to the roadbed. In the inter-track space the ballast should be cleaned to a depth of 6 in. below the bottom of the ties. If the track is to be raised, the ballast should be cleaned in advance of the raise, so that in case of rain the water can pass down to the roadbed and over the shoulder away from the track. This will also reduce the probability of heaving in freezing weather where the roadbed is full of water.

From Clogged Ballast

By T. M. Pittman
Division Engineer, Illinois Central, Waterloo, Iowa

Pumping joints are caused by the ballast becoming clogged to the point where it no longer permits the water to drain through it. This condition is aggravated by battered rail ends, by too wide openings or gaps between the rail ends and by weak ties, but the underlying cause is the condition of the ballast. The ballast may become fouled by having a bed so thin that the soil of the subgrade can work up through it; by foreign matter, such as dirt, dust, cinders or decayed vegetable matter, which becomes mixed with the ballast, or by particles of ballast grinding against each other to produce a fine dust which forms a paste when mixed with water and seals the voids in the ballast. The first condition affects the entire ballast section, while the others may be confined to a few inches immediately under the ties, leaving the ballast below this zone relatively clean.

Temporary relief can be obtained in some cases by digging the ballast away from the ends of the ties, the process known to trackmen as "bleeding the ties," to permit the water to escape. To be effective, however, this bleeding must extend to the bottom of the foul ballast and must not stop at the bottom of the ties. The real cure lies in replacing all of the muddy ballast with a fresh bed of clean material.

Imperfect Drainage

By G. Stafford
Section Foreman, Canadian National, Redland, Alta.

The presence of pumping joints is definite evidence of lack of drainage in either the ballast, the subgrade or both. Where subgrade conditions are responsible, examination usually reveals that the subgrade is composed of impervious material which has become saturated by water draining down from the track or from side areas above this level, or it is the result of capillary movement of moisture from below the track.

Where only isolated joints are affected, remedial measures are within the scope of the local maintenance forces. One method is to excavate the roadbed well below the depth of saturation and install a French drain, restoring the roadbed with a layer of fresh cinders, and the ballast with clean material. Where the trouble occurs at a number of successive joints, with evidence of churning at intermediate ties, it has obviously reached a chronic stage and is a problem for particular study and investigation before deciding on a solution. This investigation may disclose a series of ballast pockets embedded in the subgrade or that the shoulder of the roadbed has been widened and raised with impervious material, boxing the ballast so that water cannot escape from it.

In the former case, the solution may be to widen and deepen the side ditches, if it is in a cut, and then install a series of transverse drainpipes from the bottoms of the pockets to the side ditches. The latter condition has been cured by the cement grouting process in which grout is pumped under pressure into the ballast and soil to form a slab upon which the track rests.

Certain ballast materials pulverize under tamping and continued cycles of freezing and thawing; others tend to segregate under the vibrations of traffic, the fines shifting to the bottom

and thus leaving the larger pieces bunched immediately under the ties. In the course of time dirt and other matter are blown or fall on the ballast and sift down to fill the voids and block drainage, but leaving clean ballast below the superficial crust. These conditions can be corrected by excavating below the mud line and backfilling with clean ballast.

A Number of Causes

By W. Woolsey
Section Foreman, Illinois Central, Chicago

Pumping is the vertical movement under traffic of a tie that does not have solid support, or that does not rest on its bed; in other words, a loose tie. The term is most generally applied, however, to loose ties that rest in a bowl of semi-liquid mud or pulverized stone, and which splash this mud as the tie moves up and down under traffic. The immediate cause of the sloppy condition around the tie is defective drainage, and this may come from a variety of causes—by mud working up through the ballast from an incipient or a fully developed soft spot; by dirt or debris that has fallen onto the track and has sifted into the ballast; and by the decaying roots of weeds that have been burned or destroyed with chemicals.

Pumping may be started originally, and is usually magnified, by loose bolts and worn fishing surfaces which permit movement of the joint under traffic. Decayed, undersize, improperly spaced and worn ties, and battered joints, may be equally important factors in causing and prolonging pumping joints. In fact, battered joints seldom exist for any considerable time without evidence of pumping. This is also true of unmatched rails—that is, rails of unequal height that have not been ground to provide a satisfactory runoff between the two levels.

In dealing with pumping joints, ties should be given the needed attention, bolts should be tightened and worn joints should be replaced, if necessary with overfilled bars. The dirty ballast should be removed and replaced with clean material. If only a few isolated joints are involved this can be done locally; if the condition is general, and particularly if intermediate ties are pumping, a general cleaning of the ballast will be called for.

New Requirements for Inspection

Have higher speeds created new requirements with respect to the inspection of tracks and bridges? In what ways? If not, why?

It Is Not Debatable

By O. H. Carpenter
General Roadmaster, Union Pacific, Pocatello, Idaho

It is not debatable that higher speeds make necessary a more exacting inspection of both track and bridges, for the higher speeds impose a greater strain on these structures, as a consequence of which defects of every nature develop at a faster rate. We have found that low spots develop faster under high speeds than they did under the lower speeds of a few years ago. Likewise, defects in rail and fastenings, and in line and surface, may become dangerous in a much shorter time, if they are not corrected immediately after they become evident.

Defects in line and surface which are scarcely noticeable at 50 miles an hour, may be a real hazard at 80 to 90 miles an hour. It has also been noticed that the greater shocks to track incident to high speed cause more loosening and breakage of bolts and rivets in switches, frogs and other track materials. Only through frequent and close inspection by competent trackmen will these items be discovered in time to prevent hazards to trains whatever the speed.

These same principles apply with equal force to bridges where the quicker imposition of the loading and the greater vibration cause bolts, rivets and other parts of the structures to loosen and fail more quickly than they would under slower speeds. For these reasons, bridges should be inspected at more frequent intervals, in about the ratio of the increase in the speed of trains.

It must be borne in mind that any defects that are allowed to remain in tracks or bridges will have a correspondingly adverse effect on the cars and locomotives that pass over them at high speed. It is necessary, therefore, to keep the track and bridges in good condition, not only to prevent further damage or permanent injury to them, but also to the equipment passing over them. The higher the speed the greater are the requirements that the track and bridges be maintained to a high standard, and the only way to keep them in the required condition is to make frequent inspections and then correct the defects as soon as they become evident.

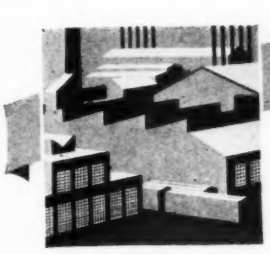
Impose More Demands

By District Engineer

It is almost axiomatic that as train speeds increase the demands that are made on tracks and bridges increase at a still faster rate, and that as the density of high-speed traffic increases there is an increasing tendency to demand perfection, at least so far as smooth riding is concerned. It is axiomatic that no train rides better than the track over which it is passing. Moreover, experience has demonstrated that no structure, whatever the service required of it, can be maintained properly unless it is given periodic inspection to determine what wear has occurred, what defects have developed and what other indications of deterioration are present.

Because of the service, often bordering on abuse, which track and bridges are called on to perform, they are particularly susceptible to the development of defects, and as train speeds increase these defects occur with increasing frequency and develop more rapidly into hazardous conditions. Almost all defects in track affect its smooth-riding qualities adversely, and since smooth riding is an essential requisite for high-speed operation, these defects must be repaired or corrected as quickly as possible after they appear. The same considerations apply to bridges, although here the question of ultimate damage to the structure and of hazard to traffic may overshadow smooth riding.

Because of these more rigid requirements, small defects must be found and corrected before they have an opportunity to grow into large ones, but this discovery can be made only by inspection. It follows that under high-speed operation these inspections should be made more frequently—and this applies to bridges and track equally—and our experience has shown that it must be more detailed and more thorough. Track inspections in the past have sometimes been more or less superficial, for it was not considered necessary to correct most defects until after they had become clearly evident. Today we endeavor to discover them in their incipient stages and do not allow them to become obvious before we attempt to correct them.



PRODUCTS of Manufacturers

New One-Man F-M Inspection Cars

Two new models of lightweight one-man inspection cars have been added to the line of motor cars built by Fairbanks-Morse & Co., Chicago. The two new cars, designated as No. 57 and No. 757, are alike as regards engine, chassis and body details but differ in the type of drive, the No. 57 having a clutch and roller chain transmission and the No. 757 having a belt drive. Both motor cars have water-cooled condensor-type single-cylinder, two-cycle, two-port, reversible type gasoline engines. These engines have a 3¾ in. bore, a 3½ stroke and develop 9 hp. The motors have battery ignition and side outlet exhaust. The cars are equipped with 3-gal. gasoline tanks.

The net weight of both models is 546 lb. The lifting weight with the handles extended is 87 lb. and 89 lb. at the rear, and 137 lb. and 133 lb. at the front, for the No. 57 and the No. 757, respectively. The overall length of both models is 87 in. and the width is 64 in. The cars have tool trays on each side, 44 in. long, 14⅜ in. wide and 3¾ in. deep. Safety rails of ¾ in. pipe are provided at the front and rear and steel non-skid toe boards extend over the wheels the full length of the car chassis along each side. The seat top is made of ⅜-in. oak and the controls extend through the seat top within easy reach of the operator when sitting in normal operating position.

The cars are equipped with 14-in. wood-center wheels of an improved design with forged steel welded hubs and wheel puller grooves. The wheels have a tapered hub and are mounted on 1 1/16-in. steel axles. A differential front axle is provided for ease of handling in moving the car on and off the track. The axle boxes are of steel with Timken bearings and are rubber mounted, providing a cushion between the axle boxes and motor car chassis. The cars have self-centering brakes with wooden brake shoes and metal facings.

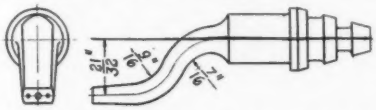
The cars are designed for operation by one man but will carry two.

The New Fairbanks-Morse Model 757 Requires a Lift, with the Handles Extended, of 89 lb. at the Rear and 133 lb. at the Front.

New Airco Flame Cutting Tips

Two new oxyacetylene flame cutting tips have been developed by Air Reduction, Style 108 for working in close quarters and Style 139 for certain machine or hand cutting operations. The Style 108 tip is bent in an offset shape and has milled flat sides with two preheat flames. The offset permits cutting 21/32 in. from the vertical center line of the torch head or barrel and meets the problem of cutting close to bulkheads, flanges or shoulders, where the radius of the torch head would prevent the vertical alinement of the cutting orifice over the desired line of cut. It is suitable for either machine or hand cutting operations and is available in sizes from No. 1 to No. 3, for cutting steel up to 1½ in. thick.

The Style 139 is a straight tip with one preheating orifice and is a companion tip to Style 119, which has two preheating orifices. It is adapted particularly to straight-line cutting, using a straight edge as a guide, or for sheet metal cutting operations in which only a light preheat is desired. The Style 139 is available in sizes Nos. 0 to 3.



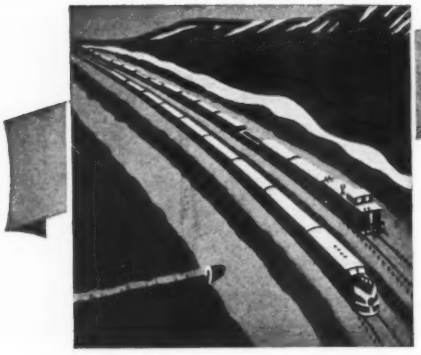
End View, and Side View of the Style 108 Off-set Oxyacetylene Cutting Tip

25-Ton Standard Speed Screw Jack

Templeton, Kenly & Co., Chicago, has added a 25-ton standard speed, bevel gear, ball-bearing screw jack, designated as No. 7300, to its line of Simplex jacks, which is adapted to heavy duty lifting or lowering and skidding in bridge and building work.

The No. 7300 25-Ton Screw Jack Has a Ratchet Operating Mechanism and Both a Cap and Toe Lift

The No. 7300 weighs 82 lb. and is mounted on a large circular base. It has both a toe and cap lift, with the toe a minimum of 11 in. from the base, but both the toe lift position and base design can be modified to suit the user's requirements. It has a full 6-in. lift and is operated by means of a bar and an enclosed ratchet mechanism. It is said that the safe mechanical action, screw adjustment and enclosed ratchet mechanism, combined with both a toe and cap lift, make the No. 7300 an ideal jack for heavy bridge and building work. It is guaranteed to lift its full rated capacity of 25 tons on the cap and 12½ tons on the toe.



NEWS of the Month

Maintenance of Way and Structures Expenditures Up

Expenditures for railway maintenance of way and structures by the Class 1 railways of the United States in July, 1942, totaled $73,487,147, the highest for any July since 1929, and compared with $54,709,486 in July, 1941, an increase of 34.3 per cent. During the first seven months of 1942, these expenditures totaled $423,474,146, the highest for any similar period since 1930, and a gain of 33.0 per cent, as compared to the same period in 1941.

Jeffers Appointed Rubber Czar

William M. Jeffers, president of the Union Pacific; has been appointed by Donald M. Nelson, chairman of the War Production Board, rubber administrator in charge of the entire rubber program. In accepting the appointment Mr. Jeffers said: "I am already at work. I intend to do whatever is necessary to carry out the assignment. I am mindful of the words used in the Baruch report, in which it is said that the existing rubber situation is so dangerous that, unless we take corrective steps, this country will face both a military and civilian collapse. This means that I have a tough job. But it is also a job for all the people of the United States. The biggest stockpile of rubber we have is on the wheels of our automobiles. I ask every motorist, every truck driver, everybody who runs a car, to remember that he is now the custodian of material more precious than gold. I cannot do any more talking now. We do not need talk—we need action."

Budd Urges Unified Transport System After the War

Urging a transportation policy after the war which would give private enterprise a free hand to create a unified transportation system, Ralph Budd, president of the Chicago, Burlington & Quincy, in an address before the regional meeting of the National Resources Planning Board at Chicago on September 17, said that overall systems combining railroads, truck and bus lines, waterways and other facilities into highly efficient enterprises that would permit each type of transport to do the work for which it is best fitted, would result if individual initiative were encouraged.

The postwar program he continued, ought to be approached as a problem divided into two parts—one involving government policy, and the other involving the projects themselves. More efficiency and economy could be assured by treating all types of transportation as parts of a unified system than by attempting to solve the problems of the railroads, the truck and bus lines, and other systems separately, Mr. Budd said.

Railroads Return Four Tons of Scrap for Every Five Tons Used

In the nation-wide campaign to collect scrap "the railroads have taken the lead, and are doing a most remarkable job," said Clyde B. Aitchison, chairman of the Interstate Commerce Commission in a round-table radio discussion on September 17, who declared that for every five tons of new steel the railroads use, they return to the mills four tons of iron and steel scrap.

According to Commissoner Aitchison, the railroads are the nation's prime source of scrap metal, ordinarily originating about one-sixth of all commercial scrap metal. Most of this scrap, he stated, is iron and steel needed to feed the steel mills. "As a result of their intensified effort," the Commissioner continued, "the railroads have salvaged hundreds of thousands of tons of scrap metal and huge quantities of other usable scrap. One railroad has increased its scrap production by 25 per cent, and this is typical of what is being done on every railroad throughout the country." In addition, Commissioner Aitchison said: "They are substituting the less critical for the more critical materials, and are changing designs in order to reduce or eliminate the need for critical materials. They are also getting the fullest possible use out of what they have, and are reclaiming and restoring worn materials."

Issues Price Regulation for Railroad Ties

The Office of Price Administration has issued an independent regulation—Maximum Price Regulation No. 216—covering railroad cross ties and switch ties, which became effective September 5. The regulation was issued because the price formulas of the General Maximum Price Regulation presented "major difficulties in establishing representative maximum prices for railroad cross ties and switch ties."

The regulation, as the OPA announcement put it, was issued "in recognition of the fact that the railroads . . . traditionally have established the prices at which railroad ties are sold by producers—mainly so-called 'tie hackers' and small sawmill operators"; and thus it sets maximum prices on the basis of the buyer's price rather than the seller's. In general, the prices are fixed at the highest level at which the buyer purchased ties during the period January 1, 1942, to March 31, 1942.

Other factors which made the separate regulation desirable, according to OPA, were the fact that almost every road purchases ties according to its own specifications; and the entrance of the government into the market as a large-scale buyer of ties. The regulation covers "approximately 88 per cent of total tie production, including those manufactured in the Southern pine, and Central hardwood regions, from oak, pine, gum and cypress and those produced east of the Rocky Mountains from lodgepole pine, ponderosa pine, beech, birch and maple." The announcement went on to say that the remainder of the tie output is covered by Maximum Price Regulation 26 (Douglas Fir and Other West Coast Lumbers) and a contemplated regulation for redwood.

Forecasts 15 Per Cent Traffic Rise in 1943

Railroad passenger and freight traffic may increase approximately 15 per cent in 1943, M. J. Gormley, executive assistant of the Association of American Railroads, predicted at Toledo on September 16 in an address before the Great Lakes Regional Advisory Board.

"There is every indication that traffic will continue to rise next year," Mr. Gormley said, "but that the monthly rate of increase will not be as great as in 1942. War production is certain to increase. Troop movements will increase as our Army and Navy are enlarged. Passenger business will go up as the use of rubber-tired and gasoline-driven vehicles decreases. The railroads will continue to handle such unaccustomed loads as the oil movement to the East and the all-rail movement of coal into New England. On the other hand, civilian production will probably fall to minimum levels in 1943."

Pointing out that the mass production of war materials is of no value unless they can be transported to where they are needed, Mr. Gormley urged: "Let us not make the same mistake that Hitler made in neglecting Germany's railroads. Now, according to newspaper correspondents who recently returned from Germany, that country faces a serious breakdown of its

railroads, and the transportation situation is becoming a genuine threat to the military effort of the Reich.

"Let us not be led to believe that because the railroads have been able to do such an outstanding job with their present equipment, they can handle substantial increases in traffic without adding cars and locomotives."

Mr. Gormley estimated that railroad freight traffic, as measured by the number of tons hauled one mile, will be about 30 per cent more this year than it was in 1941, and that railroad passenger business, as measured by the number of passengers carried one mile, will be approximately 50 per cent greater this year than last.

Volume of Troop Movement Three Times That of World War I

Troop movements during the first nine months of the present war have been more than three times the number during the comparable period of World War I, the War Department has announced. "Close cooperation between the nation's railroads and the Transportation Corps, Services of Supply," the statement said, "made it possible to accomplish these movements without serious disruption of civilian traffic, although many of them took place at the peak of a holiday season, and were accompanied by enormous loads of military freight."

In the nine-month period beginning December 7, 1941, troop movements by rail totalled approximately 6,500,000, as opposed to 1,916,417 for the first nine months of the last war. In June, 1942, the Transportation Corps moved almost a million soldiers by rail, as opposed to 308,000 in June, 1917.

"The rapid development of the 1941 emergency movements," the statement went on, "was achieved with less rolling stock than was available during a like period in 1917. At the time of the 1917 mobilization, a nation-wide inventory showed 2,596,252 locomotives, coaches, freight, passenger, and baggage cars in the service of the railways, whereas at the start of hostilities in 1941, less than 2,000,000 cars and locomotives were at the disposal of the Army. The present expeditious movement of troops may be accounted for by several factors, perhaps the most important of which was detailed advance planning by the Transportation Corps. Mechanical elements contributing to the success of the operations included more effective motive power, permitting longer trains; decrease in turn-around time; better coordination between the Army and the railroads; and increased speed of trains."

The American soldier was moved an average of three times between induction and embarkation for overseas in 1917-18. Today, he averages six moves before he leaves the country, "reflecting the more intensive training program now employed." Present-day transportation problems, the statement also said, have been complicated by "the great increase in military freight traffic, the result in part of large-scale mechanization of the Army." These requirements of the Army during the past nine months "have been twice those of the entire last war."

Association News

Maintenance of Way Club of Chicago

The first fall meeting of the club will be held on Monday, October 26, in the Ambassador room of Huyler's restaurant in the Straus building, 310 So. Michigan Ave., Chicago. Dinner will be served at 6:30 p.m., followed by a program which promises to be of unusual interest.

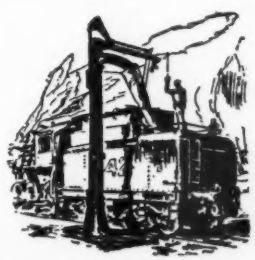
American Railway Engineering Association

Seven of the standing committees of the association plan meetings during October, four concurrent with the annual meeting of the American Railway Bridge and Building Association, in Chicago, October 20-22, to afford members of the committees opportunity to attend sessions of the Bridge and Building meeting. The committees convening in October are: Iron and Steel Structures, on October 8 and 9, at Pittsburgh, Pa.; Yards and Terminals, at Cleveland, Ohio, on October 14; Waterproofing of Railroad Structures, at New York, on October 15 and 16; Water Service, Fire Protection and Sanitation, at Chicago, on October 20; Wood Bridges and Trestles, at Chicago, on October 21; Buildings, at Chicago, on October 21 and 22; and Wood Preservation, at Chicago, between October 20 and 22.

During October, the September-October bulletin of the association, No. 433, will be mailed to members. This bulletin, among other things, will include a detailed report of the Committee on Impact, and a monograph by Roscoe Owen, on Pile Tests.

Nine committees met during September, five in conjunction with the Roadmasters' annual meeting. The committees include the following: Uniform General Contract Forms, at New York, on September 9; Economics of Railway Labor, at Chicago, on September 15; Water Service, Fire Protection and Sanitation at Chicago, on September 15; Maintenance of Way Work Equipment, at Chicago, on September 15 and 16; Roadway, at Chicago, on September 15 and 16; Rail, at Chicago, on September 16; Track, at Chicago, on September 16; Waterways and Harbors, at Chicago, on September 23; and Economics of Railway Location and Operation, at Chicago, on September 29.

Adding to its growing list of Emergency Provisions, two additional Emergency Provisions of association specifications were issued during September, one having to do with specifications for spring washers, which permits lower reactive pressures if specified by the purchaser. In the other Emergency Provision, which has to do with unit stresses in steel railway bridges of fixed span not exceeding 400 ft. in length, the major modification increases the allowable unit stress for structural and rivet steel from 18,000 lb. per sq. in. to 22,000 lb. per sq. in.



Bridge and Building Association

With a program keyed specifically to the problems confronting bridge, building and water service men in these war-time days, the American Railway Bridge and Building Association will hold its forty-ninth annual meeting at the Sherman Hotel, Chicago, on October 20-22. Giving special attention to materials, scrap, labor, car utilization and other problems arising from increased traffic and higher train speeds, the program will include addresses by representatives of WPB, ODT and the Association of American Railroads and individual railroads, in addition to the reports of eight technical committees. The program follows:

Tuesday, October 20

Morning Session—10:00 A. M.

Convention called to order.

Opening address by C. E. Johnston, chairman, Western Association of Railway Executives, Chicago, on Problems That Concern Us.

Greetings from the American Railway Engineering Association, H. R. Clarke (chief engineer maintenance of way, C. B. & Q. System, Chicago), president.

Greetings from the Roadmasters' and Maintenance of Way Association, E. L. Banion (roadmaster, A. T. & S. F., Topeka, Kan.), president.

Address by President R. E. Dove, assistant engineer, C. M. St. P. & P., Chicago.

Report of Committee on Preventing Accidents Among Bridge and Building Employees; E. H. Barnhart, chairman (division engineer, B. & O., Garrett, Ind.).

Afternoon Session—2:00 P. M.

Report of Committee on the Cleaning of Masonry Structures; W. A. Huckstep, chairman (general building supervisor, M. P., St. Louis, Mo.).

Address on the Protection of Railway Structures in Time of War, by B. R. Kulp, chief engineer, C. & N. W., Chicago.

Report of Committee on Meeting the Demands for Increased Water Supplies in Fast Freight Service; J. P. Hanley, chairman (water service inspector, Illinois Central, Chicago).

Tuesday Evening—8:00 P. M.

A program on the Blackout of Railway Structures.

Wednesday, October 21

Morning Session—9:00 A. M.

Report of Committee on Wearing Surfaces for Building Floors, Platforms and Roadways; T. H. Strate, chairman (division engineer, C. M. St. P. & P., Chicago).

Address on the Outlook for Labor in Bridge, Building and Water Service, by Edwin M. Fitch, assistant director,

Division of Transport Personnel, ODT, Washington, D.C.

Report of Committee on Conservation of Bridge, Building and Water Service Supplies; F. G. Campbell, chairman (assistant chief engineer, E. J. & E., Joliet, Ill.).

Luncheon—12:15 P. M.

Address by Ralph Budd, president, Burlington System, Chicago, and former transportation commissioner, The Advisory Commission to the Council of National Defense.

Afternoon Session—2:00 P. M.

Materials in Wartime

Address on Critical Materials for Bridge, Building and Water Service Work, by David P. Beach, assistant chief, Maintenance Equipment Section, War Production Board, Washington, D.C.

Addresses on What We Can Do to Meet the Material Situation:

(a) As Bridge Men, by J. B. Hunley, bridge engineer, New York Central, Lines West of Buffalo, Chicago.

(b) As Building Men, by A. L. Sparks, architect, Missouri-Kansas-Texas, St. Louis, Mo.

(c) As Water Service Men, by G. E. Martin, superintendent of Water Service, Illinois Central, Chicago.

Address on Possibilities for Reclamation and Salvage, by R. P. Hart, bridge engineer, Missouri Pacific, St. Louis, Mo.

Wednesday Evening—7:00 P. M.

Informal Dinner, followed by an address and moving pictures, by Sam Campbell, Naturalist.

Thursday, October 22

Morning Session—9:00 A. M.

Report of Committee on Rail Fastenings on Bridges, Pits and Turntables; J. S. Hancock, chairman (bridge engineer, D. T. & I., Dearborn, Mich.).

Address on Reducing Demands for Cars and Locomotives for Handling Bridge, Building and Water Service Materials in a Period of Maximum Traffic, by W. D. Beck, district manager, Car Service division, A. A. R., Chicago.

Report of Committee on the Repair of Steel Bridges, A. R. Harris, chairman (assistant engineer bridges, C. & N. W., Chicago).

Afternoon Session—2:00 P. M.

Report of Committee on Piles and Pile Driving; W. F. Martens, chairman (general foreman, bridge, building and water service, A. T. & S. F., San Bernardino, Cal.).

Address on What We Have Gotten from This Meeting to Help Us Maintain Railway Structures for Our All-Out War Effort, by A. E. Bechtelheimer, bridge engineer, C. & N. W., Chicago.

Business Session.

Data Book on Lifting Jacks.—Catalog 200, a 64-page newly revised book of data on industrial jacks, has been published by the Duff-Norton Manufacturing Company, Pittsburgh, Pa. The catalog gives complete information on the more than 300 types and sizes of Duff-Norton jacks. It is of convenient handbook size and well indexed to save time in reference.

Personal Mention

General

J. M. Miller, division engineer of the Elkins division of the Western Maryland, with headquarters at Cumberland, Md., has been promoted to trainmaster, with the same headquarters.

Curtis B. Bennett, vice-president and secretary of the Cleveland Railway Company (Cleveland, Ohio, traction company), and an engineer by training and experience, has been appointed assistant to the vice-president of the Chesapeake & Ohio, the New York, Chicago & St. Louis and the Pere Marquette, with headquarters at Cleveland. Mr. Bennett was born in Richmond, Ky., on August 23, 1897, attended Culver Military Academy and graduated in civil engineering in 1919 from Cornell University. He joined the Cleveland Railway Company as field and office engineer immediately after graduation. He was assistant superintendent of the way department of that company from 1932 to 1935; property engineer, from 1935 to 1937; secretary, from 1937 to 1940; and, thereafter, vice-president and secretary. In his new position with the Chesapeake & Ohio lines, Mr. Bennett will be assigned research and work of a specialized character.

Vernon P. Turnburke, general auditor of the Great Northern, with headquarters at St. Paul, Minn., and an engineer by training and experience, has been promoted to assistant to the president. Mr.

Vernon P. Turnburke

Turnburke was born in Washington, D.C., and entered railway service as a messenger boy on the Pennsylvania. He later attended the University of Michigan, graduating in civil engineering in 1911. He then returned to railway service in the bridge engineering department of the Michigan Central at Detroit, and later went with the Chicago, Milwaukee, St. Paul & Pacific at Chicago on similar work, later being assigned to statistical work. In 1917 Mr. Turnburke went with the Great Northern as statistician. A year later he was drafted by the government for war work in Washington in connection with the Federal control of railroads and at the end of Federal control in 1920, he was manager of the operating statistics section. Returning to the Great Northern, he continued as statistician, and in 1925 he was advanced to general auditor, which position he held until his recent promotion, effective September 1.

Herman T. Frushour, general superintendent of the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., and an engineer by training and experience, has been promoted to general

Herman T. Frushour

manager of the New York zone, with headquarters at New York. **John A. Schwab,** superintendent of the Buffalo division, with headquarters at Buffalo, N.Y., and also an engineer by training and experience, has been advanced to superintendent of frieight transportation of the Eastern region, with headquarters at Philadelphia, Pa.

Mr. Frushour was born at Logansport, Ind., on February 17, 1882. Following his graduation from high school in that city, Mr. Frushour served as rodman and locomotive fireman on the Logansport division of the Pennsylvania. He then entered Purdue University, graduating in civil engineering in 1907. Returning to the Pennsylvania as assistant on the engineering corps, he served as assistant engineer at Cincinnati, Ohio, and division engineer at Cleveland, Ohio. On July 1, 1928, he became superintendent of the Monongahela division at Uniontown, Pa., later being transferred successively to the Erie and Ashtabula, the St. Louis and the Eastern divisions. On November 1, 1935, Mr. Frushour became superintendent of the Long Island railroad at Jamaica, N.Y. He became general superintendent of the Western Pennsylvania division of the Pennsylvania at Pittsburgh on September 16, 1939, which position he held until his recent promotion to general manager of the New York zone.

Mr. Schwab was born at Menoken, N.D., on July 26, 1903. He enlisted in the Signal Corps of the Regular Army in December, 1919, and served in this branch of the service until July, 1923, when he entered the United States Military Academy at West Point, N.Y., from which he was graduated in June, 1927, being assigned to the Air Corps at Brooks Field, Texas. He resigned from the Army in October, 1927, and entered the service of the Pennsyl-

(Continued on page 744)

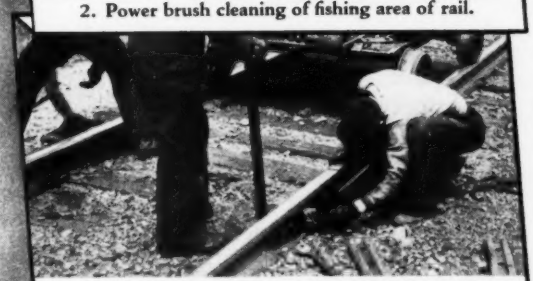
RAIL JOINTS TREATED ONCE WITH NO-OX-ID CAN BE FORGOTTEN

Treating the entire rail joint assembly, consisting of angle bars, track bolts, rail ends, and bond wires, with NO-OX-ID does two things . . . prevents corrosion of these parts caused by brine drippings, cinders, moisture, and other rust accelerators and acts as a long lasting lubricant which prevents rail joints from freezing.

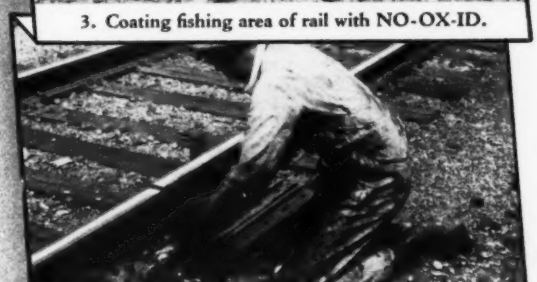
NO-OX-ID is easily applied as indicated by the accompanying pictures. It provides two way protection against corrosion . . . mechanically to exclude moisture and gases and chemically to inhibit corrosion. Heavy loads and high speed trains, which create excessive vibration, have no deteriorating effect on NO-OX-ID. Write for complete details.

1. Flame cleaning and scraping fishing area of rail.

2. Power brush cleaning of fishing area of rail.



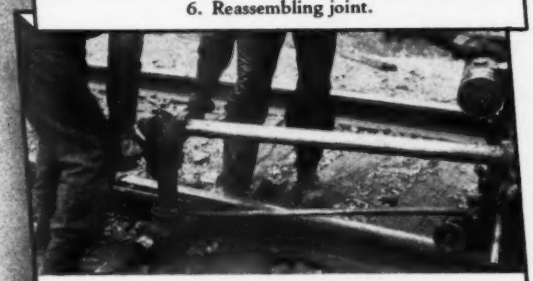
3. Coating fishing area of rail with NO-OX-ID.



4. Coating angle bars with NO-OX-ID.

5. Coating track bolts with NO-OX-ID.

6. Reassembling joint.



7. Tightening track bolts.

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vania on November 8, 1927, as a rodman in the engineering corps of the Eastern region. He was advanced to assistant supervisor of track on November 10, 1928, and served in that capacity on the Williamsport, Philadelphia Terminal and Maryland divisions. Mr. Schwab was promoted to supervisor of track on February 11, 1930, serving on the Elmira, Williamsport and Maryland divisions, as well as in the general office of the Eastern region at Philadelphia, until May 23, 1934, when he became assistant division engineer of the Middle division. He was appointed acting division engineer of the Eastern division on Novemebr 1, 1935, becoming division engineer of that division on June 1, 1936. Mr. Schwab was promoted to superintendent of the Logansport division on January 15, 1938, being transferred to the Delmarva division on April 1, 1939, and to the Buffalo division on January 16, 1941, where he remained until his recent promotion.

Felix S. Hales, bridge engineer of the New York, Chicago & St. Louis (Nickel Plate), with headquarters at Cleveland, Ohio, has been promoted to assistant general superintendent, with the same headquarters, succeeding **J. C. Wallace,** whose promotion to chief engineer is reported elsewhere in these columns. Mr. Hales was born at Wilson, N.C., on April 13, 1893, and graduated in engineering from North Carolina State college in 1913, and in civil engineering from Cornell University in 1916. He entered railway service in 1916 as a draftsman for the Nickel Plate on grade elimination work and served in that capacity until June, 1918, when he joined the U. S. Army as a second lieutenant in the field artillery. He returned to his former position with the Nickel Plate in December, 1918, and in 1919 he was appointed assistant to the corporate chief engineer. In 1920, Mr. Hales was appointed assistant engineer in charge of bridge design and steel inspection and in April, 1924, he was transferred to the track department as assistant engineer. Four months later, he was promoted to engineer of track, with headquarters as before at Cleveland, and his jurisdiction was extended to include the Lake Erie and Western district in 1925 and the entire system in 1927. In 1928, Mr. Hales was appointed engineer of the Cleveland Terminal improvements, and in 1934 he returned to his former position as engineer of track. On December 1, 1939, he was promoted to bridge engineer, which position he held until his recent promotion, effective September 1.

Engineering

R. S. Clark, assistant engineer on the Chicago & Eastern Illinois, with headquarters at Chicago, retired on September 2 and is now living at Evansville, Ind.

W. H. Stockley, assistant division engineer on the Atchison, Topeka & Santa Fe at San Bernardino, Cal., has been appointed office engineer at that point, and **Leon E. Smith,** roadmaster at Los Angeles, Cal., has been advanced to assistant division engineer at San Bernardino, succeeding Mr. Stockley. **J. M. Terrass,** assistant division engineer at Needles, Cal., has been transferred to Fresno, Cal., and **H. E. Preece,** roadmaster at Richmond, Cal., has been promoted to assistant division engineer at Needles, replacing Mr. Terrass.

E. L. Rankin, architect of the Gulf, Colorado & Santa Fe at Galveston, Tex., has been commissioned a captain in the Corps of Engineers, U. S. Army, with headquarters at Galveston.

G. M. Rowe, roadmaster on the Southern Pacific at Los Angeles, Cal., has been promoted to acting assistant division engineer on the Los Angeles division, a newly created position.

O. P. Shallenberger has been appointed assistant engineer on the Denver & Rio Grande Western at Pueblo, Colo., succeeding **R. F. Exline,** whose appointment as roadmaster at Walsenburg, Colo., is reported elsewhere in these columns.

E. C. Shreve, assistant division engineer of the Western Maryland, with headquarters at Hagerstown, Md., has been promoted to division engineer of the Elkins division, with headquarters at Cumberland, Md., succeeding **J. M. Miller,** whose promotion to trainmaster is reported elsewhere in these columns.

R. T. Blewitt, designing engineer in the bridge department of the New York, Chicago & St. Louis (Nickel Plate) at Cleveland, Ohio, has been promoted to bridge engineer, with the same headquarters, succeeding **Felix S. Hales,** whose promotion to assistant general superintendent is reported elsewhere in these columns.

F. H. Simpson, assistant district engineer of the New York Central (Michigan Central) at Detroit, Mich., has been transferred to the Lines West of Buffalo, with headquarters at Cleveland, Ohio, succeeding **L. B. Holt,** who retired on September 30. **E. J. Bayer,** division engineer at Weehawken, N.J., has been promoted to assistant district engineer at Detroit, succeeding Mr. Simpson.

Walter C. Schakel, assistant division engineer of the Ohio division of the New York Central (Big Four) at Bellefontaine, Ohio, has been promoted to assistant engineer of structures, with headquarters at Cincinnati, Ohio, succeeding **G. E. Robinson,** who has been transferred to the Lines West of Buffalo, with headquarters at Cleveland, Ohio, replacing **V. K. Hoffner,** who retired on September 30. Mr. Schakel was born at Indianapolis, Ind., on September 12, 1890, and attended the University of Cincinnati. He entered railway service in 1916 in the office of the chief engineer of the Big Four at Cincinnati, Ohio, and in 1924 was promoted to assistant engineer maintenance of way of the Peoria & Eastern (part of the New York Central system), with headquarters at Indianapolis. Mr. Schakel was transferred to the Cairo division of the Big Four at Mt. Carmel, Ill., in 1929 and four years later he returned to the P. & E. at Indianapolis, as assistant engineer maintenance of way. In July, 1939, he was promoted to office engineer of the Big Four, with headquarters at Cincinnati and on May 15, 1942, he was advanced to assistant division engineer at Bellefontaine, which position he held until his recent promotion.

Harry M. Noel, whose promotion to division engineer on the Missouri Pacific, with headquarters at Poplar, Bluff, Mo., was reported in the August issue, was born at Valencia, Kan., on July 15, 1888, and graduated in civil engineering from Kansas State college in 1912. He entered railway service on December 21, 1913, on the Atchison, Topeka & Santa Fe. On October 2, 1919, he went with the Missouri Pacific as an instrumentman at Atchison, Kan., later being transferred to Wichita, Kan. On October 1, 1925, he

Harry M. Noel

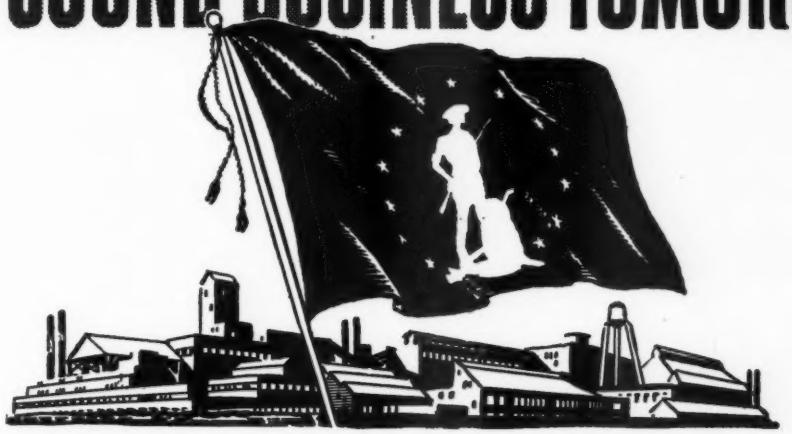
obtained a leave of absence and served as construction superintendent for the Sun Oil Company at Miami, Fla., until May 17, 1926, when he returned to the Missouri Pacific as field engineer at Little Rock, Ark. One month later he was appointed assistant engineer at Wichita and on July 15, 1927, he was appointed assistant roadmaster at Washington, Mo. Mr. Noel was promoted to roadmaster at Sedalia, Mo., on May 10, 1928, and was transferred to Boonville, Mo., on August 1, 1929, to Carthage, Mo., on September 1, 1930, and to St. Louis, Mo., on July 15, 1936. He was located at the latter point until his recent promotion, effective August 1.

F. W. Armistead, division engineer of the Springfield division of the Illinois Central at Clinton, Ill., who was assigned to other duties because of illness, as reported in the July issue, retired on August 1. Mr. Armistead was born on September 20, 1883, and entered railway service on May 17, 1905, as a chainman on the Illinois Central. He advanced through various positions and on July 1, 1926, he was promoted to roadmaster of the Indiana division, with headquarters at Mattoon, Ill. On April 1, 1931, when the Indiana and Springfield divisions were consolidated he was transferred to Clinton as division engineer of the Springfield division.

J. C. Wallace, assistant general superintendent of the New York, Chicago & St. Louis (Nickel Plate), with headquarters at Cleveland, Ohio, has been promoted to chief engineer, with the same headquarters, succeeding **Alvin C. Harvey,** whose death on August 22 was reported in the

(Continued on page 746)

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW



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This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

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It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

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This Space Is a Contribution to America's All-Out War Program by

RAILWAY ENGINEERING AND MAINTENANCE

September issue. Mr. Wallace was born at Harrisburg, Pa., on November 1, 1886, and graduated in civil engineering from Pennsylvania State college in 1911. He entered railway service in April, 1914, as a structural draftsman on the Chicago, Milwaukee, St. Paul & Pacific and four years later he went with the Lake Erie & Western (now part of the Nickel Plate), as engineer of structures, later becoming district engineer at Indianapolis, Ind. In May, 1925, Mr. Wallace was promoted to assistant chief engineer of the Nickel Plate, with headquarters at Cleveland, and on September 1, 1940, he was advanced to assistant general superintendent, with the same headquarters, the position he held until his recent promotion, effective September 1.

Warren L. Peoples, assistant engineer maintenance of way and structures of the Wheeling & Lake Erie, has been promoted to engineer maintenance of way and structures, with headquarters as before at Brewster, Ohio, succeeding **William Albert Roderick,** whose death on July 17 was reported in the August issue. Mr.

Warren L. Peoples

Peoples was born at Bolivar, Ohio, on August 12, 1896, and graduated in civil engineering from Ohio Northern University in 1917. In 1913 and 1914 he worked as timekeeper for a railroad contractor at Norwalk, Ohio, and in 1917 he entered railway service as a transitman in the valuation department of the W. & L. E. From August, 1918, to January, 1919, he served as a sergeant engineer in the U. S. Army, returning to the W. & L. E. on the latter date as a transitman. Mr. Peoples was promoted to assistant engineer in 1924, to roadmaster in 1926 and to superintendent of bridges and buildings in 1927. The following year he was advanced to assistant engineer mantenance of way and structures, with headquarters at Brewster, which position he held until his recent promotion.

Ralph E. Patterson, who has been acting chief engineer, construction and maintenance of the Lehigh Valley at Bethlehem, Pa., has been appointed chief engineer, construction and maintenance. Mr. Patterson was born on March 9, 1889, at Bangor, Me. He graduated in civil engineering from the University of Maine in 1911 and entered railroad service in the engineering corps of the Lehigh Valley at Buffalo, N.Y., in October, 1912. In April, 1916, he was appointed assistant division engineer at Sayre, Pa., being transferred to Buffalo the following month. He was promoted to division engineer in July, 1920, which position he held successively at Hazleton, Pa., Sayre and Easton. On August 1, 1937, Mr. Patterson was promoted to assistant to chief engineer at Bethlehem and on December 1, 1940, he became engineer maintenance of way. Mr. Patterson was appointed acting chief engineer, construction and maintenance, on June 1, which position he held until September 1, when he became chief engineer, construction and maintenance.

S. T. Robertson, whose promotion to district maintenance engineer on the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., was reported in the August issue, was born at Bivins, Tex., on July 7, 1900, and entered Rock Island service in March, 1929, as a rodman at Ft. Worth, Tex. He later served successively as section laborer at Chico, Tex., signal helper on the Panhandle-Indian Terirtory division, rodman and chainman on the Oklahoma and Southern divisions and trucker at Ringgold, Tex. In January, 1933, Mr. Robertson was appointed track inspector, later being appointed track supervisor. From June 2, 1938, to April 1, 1939, he served as roadmaster and track supervisor at various points on the Oklahoma and the Arkansas-Louisiana divisions. Mr. Robertson was advanced to acting roadmaster at Chickasha, Okla., on the latter date and on October 9, 1939, he was transferred to Little Rock, Ark. On April 24, 1942, he was promoted to engineer-roadmaster of the Burlington-Rock Island, with headquarters at Houston, Tex., which position he held until his promotion, on July 1, to district maintenance engineer on the Rock Island.

C. H. Hardwick, whose promotion to engineer maintenance of way of the Chicago, Rock Island & Pacific, with headquarters at Chicago, was reported in the August issue, was born at Atlantic, Iowa, on February 9, 1902, and attended Iowa State College in 1919, 1920 and 1921. He entered railway service on June 9, 1917, as a section laborer on the Rock Island at Atlantic and served in this capacity during summer vacations for four consecutive years. After attending Iowa State College, he entered other employment but returned to the Rock Island in 1929 as a section foreman, later serving as an extra gang and construction foreman. In 1932, Mr. Hardwick was promoted to track supervisor, with headquarters at Manly, Iowa, and later that year, because of a reduction in force, returned to the position of section foreman on the Iowa division. In 1934, he was appointed a steel gang foreman and later served as an assistant roadmaster in charge of one of the system rail laying gangs. In October, 1936, he was advanced to roadmaster at Peoria, Ill., two months later being transferred to Iowa City, Iowa. Mr. Hardwick was transferred to Fairbury, Neb., in April, 1937, and to El Reno, Okla., in October, 1937. On February 1, 1940, he was promoted to district maintenance engineer at El Reno, Okla., and four months later, he was transferred to Kansas City, where he remained until his recent promotion, effective July 1.

Charles T. Warren, division engineer of the Wabash at Decatur, Ill., has been promoted to engineer of track, with headquarters at St. Louis, Mo., succeeding **V. R. Hayes,** who has been appointed division engineer of the Ann Arbor (Wabash subsidiary), with headquarters at Owosso, Mich. Mr. Hayes replaces **W. R. Bennett,** who has resigned to accept a position with the U. S. Engineers. **R. S. Stephens,** supervisor of work equipment

Charles T. Warren

of the Wabash, with headquarters at Decatur, has been appointed division engineer at that point, relieving Mr. Warren.

Mr. Warren was born at Elizabethtown, Ky., on August 2, 1899, and graduated in civil engineering from Ohio Northern University in 1925. He entered railway service on October 1, 1925, as a bridge inspector and rodman on the Wabash at St. Louis, and on April 1, 1926, he was promoted to assistant engineer at Detroit, Mich. Mr. Warren was appointed maintenance inspector, with headquarters at St. Louis, on July 1, 1928, and on March 1, 1929, he was promoted to acting division engineer at Detroit. Three months later, he was appointed assistant engineer at Montpelier, Ohio, and on June 1, 1931, he was appointed track supervisor at La Fayette, Ind. Mr. Warren was promoted to division engineer of the Ann Arbor, with headquarters at Owosso, on August 1, 1934, and on March 10, 1936, he was transferred to the Wabash at Decatur, which position he held until his recent promotion, effective July 29.

Track

J. A. Smith, section foreman on the New York Central (Big Four), has been promoted to supervisor of track at Galion, Ohio, succeeding **Kenneth Short,** assigned to other duties.

Robert Stewart, extra gang foreman on the New York Central, has been promoted to assistant supervisor of track of Subdivision 31 of the St. Lawrence division, with headquarters at Remsen, N.Y., to succeed **A. S. Williams,** whose death is noted elsewhere in these columns.

(Continued on page 748)

Results like this show why..

Pozzolith Railroads..

from REPORT OF BRIDGE ENGINEER*

Date: January—February, 1942

Job: Bridge Abutment (In N. Y. State)

"Concrete mix was designed with Pozzolith . . . four advantages gained:

1. Savings in cost of materials alone ***more than offset cost of Pozzolith*** . . .
2. Concrete was ***more workable*** even though water was reduced 20% . . .
3. ***Faster placing*** reduced cost by saving man-hours . . .
4. Tests showed ***higher strengths*** at all ages enabling us to remove forms earlier than customary . . .

Other experiences with Pozzolith over a period of several years have been equally satisfactory."**

Pozzolith has been used in millions of yards of concrete in recent months to gain speed, higher strength, easier placeability, greater density and watertightness, and economy. Are you interested in these advantages?

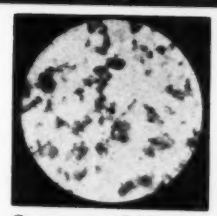
Write today for illustrated Pozzolith booklet and Research Papers No. 36—"Economics of Cement Dispersion" (for mass concrete) and No. 39—"Cement Dispersion and Air Entrainment" (for runways and pavement).

THE MASTER BUILDERS COMPANY
CLEVELAND, OHIO TORONTO, ONTARIO

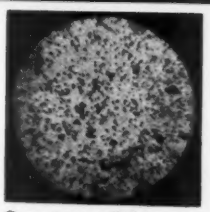
*Name of Railroad on Request
**Cement Dispersion has a 10-year record of successful performance.

HOW CEMENT DISPERSION WORKS

In a normal concrete mix, cement particles tend to bunch together, thereby (1) limiting hydration and (2) trapping water within the cement clumps. (See photomicrograph at right).



Cement suspended in water
UNDISPERSED
WITHOUT POZZOLITH



Cement suspended in water
DISPERSED
WITH POZZOLITH

Cement Dispersion drives these particles apart and (1) exposes their entire surface area to hydration, at the same time (2) making the water entrapped in the clumps available for lubrication of the mix. (See photomicrograph at left).

MASTER BUILDERS

Max P. Arnold, section foreman on the Illinois Central at West, Miss., has been promoted to supervisor of track on the Grenada district, at Grenada, Miss., succeeding **G. R. Wilkinson,** who retired on September 1.

R. F. Exline, assistant engineer on the Denver & Rio Grande Western at Pueblo, Colo., has been promoted to roadmaster at Walsenburg, Colo., succeeding **John B. Harvey,** whose promotion to master carpenter at Alamosa, Colo., is reported elsewhere in these columns.

J. Louis Desselle, whose promotion to roadmaster on the Gulf Coast Lines (Missouri Pacific), with headquarters at Beaumont, Tex., was reported in the August issue, was born at Moreauville, La., on December 11, 1905, and entered railway service on November 27, 1926, as a section laborer on the Gulf Coast Lines. In June, 1927, he was promoted to section foreman and served in that capacity and as extra gang foreman until January, 1942, from which date he served as acting roadmaster and section foreman until his recent promotion.

R. J. McEwen, assistant supervisor of track on the New York Central at Toledo, Ohio, has been promoted to supervisor of track at Corning, Ohio, succeeding **H. E. Wall,** who has been transferred to Painesville, Ohio. Mr. Wall relieves **R. A. Houghton,** who has been transferred to Kenton, Ohio, replacing **William A. Smith,** whose transfer to Dunkirk, N.Y., was reported in the September issue. **P. S. Margraf,** general foreman on the Michigan Central at Kalamazoo, Mich., has been advanced to assistant supervisor of track at Toledo, succeeding Mr. McEwen.

T. J. Vanzandt has been appointed roadmaster on the Southern Pacific at Glendale, Ore., succeeding **R. D. Sorrels,** who has been transferred to Los Angeles, Cal., replacing **Jack Stewart,** whose promotion to assistant division engineer at El Paso, Tex., was reported in the July issue. **H. W. Neuebaumer** has been appointed acting roadmaster at Los Angeles, relieving **G. M. Rowe,** whose appointment as acting assistant division engineer is reported elsewhere in these columns. **J. Stitt** has been appointed roadmaster at Susanville, Cal., succeeding **E. E. Edwards.**

Clarence M. Gregg, whose promotion to supervisor of track of Subdivision 27 of the Pennsylvania division of the New York Central, with headquarters at Clearfield, Pa., was reported in the August issue, was born on December 3, 1897, at Rynex Corner, N.Y., and is a graduate in civil engineering of Union college. He entered railway service with the New York Central as a draftsman at New York on February 27, 1924. On April 16 of the same year, he was advanced to transitman at the same point, being transferred to Watertown, N.Y., on May 19, 1929. Mr. Gregg was promoted to assistant supervisor of track at Remsen, N.Y., on October 1, 1937, being transferred to New York on July 1, 1938. On March 1, 1941, he was appointed assistant engineer on the Electric division, with the same headquarters, which position he held until his recent promotion, effective July 1.

H. W. Green, track supervisor on the Atchison, Topeka & Santa Fe at Newton, Kan., has been promoted to roadmaster at Chanute, Kan., succeeding **C. C. McGuire,** who retired on October 1. **W. C. Cagle,** assistant roadmaster at Los Angeles, Cal., has been advanced to roadmaster at that point, replacing **Leon E. Smith,** whose promotion to assistant division engineer at San Bernardino, Cal., is reported elsewhere in these columns, and **J. H. Bell,** track supervisor at Oceanside, Cal., has been promoted to assistant roadmaster at Los Angeles, relieving Mr. Cagle. **K. K. Rogers,** track supervisor at Visalia, Cal., has been advanced to roadmaster at Richmond, Cal., succeeding **H. E. Preece,** promoted.

Peyton T. Anderberg, whose promotion to track specialist of the Eastern district of the Union Pacific, with headquarters at Omaha, Neb., was reported in the August issue, was born at Sandy, Utah, on December 31, 1903, and studied engineering at various schools for three years during the period 1921-1925. He entered railway service on December 5, 1925, as a rodman on the Union Pacific at Green River, Wyo., and in October, 1927, he was promoted to instrumentman. In June, 1935, he was advanced to assistant engineer at Omaha and in March, 1937, he went with the Utah Construction Company as a construction engineer, working in Nebraska and Montana. Mr. Anderberg returned to the Union Pacific as an instrumentman at Omaha in May, 1940, and five months later, he was appointed assistant roadmaster at Lawrence, Kan. He was promoted to roadmaster at Valley, Neb., on January 1, 1941, which position he held until his recent promotion.

J. B. Martin, general inspector of track of the New York Central, Lines West of Buffalo, with headquarters at Cleveland, Ohio, retired on September 30. Mr. Martin was born at Espyville, Pa., on October

J. B. Martin

1, 1882, and entered railway service in 1897 on the Lake Shore & Michigan Southern (now part of the New York Central system), where he was employed consecutively in clerical capacities in the engineering department, on special construction, and as assistant roadmaster at various points. In 1905 he was promoted to roadmaster on the Monroe division of the New York Central and then served successively as roadmaster and supervisor on the Lansing, D. A. V. & P., Alliance, old Road and Elkhart divisions. On January 1, 1924, Mr. Martin was advanced to general inspector of track of the Lines West of Buffalo, with headquarters at Cleveland, which position he held until his retirement. Mr. Martin was the first president of the Maintenance of Way Club of Chicago, organized in 1921. He has also been active for many years in the Roadmasters' and Maintenance of Way Association of America and served as president of that association in 1924. Mr. Martin has also been a member of the American Railway Engineering Association since 1924 and was chairman of a subcommittee of the Committee on Economics of Railway Labor which submitted a report in 1939 on Sanitary Provisions in Camps and Cars for Housing Labor. Mr. Martin is also the author of numerous articles on track maintenance problems which have appeared, from time to time in *Railway Engineering and Maintenance.*

Bridge and Building

J. W. Welch has been appointed acting supervisor of bridges and buildings of the Florida East Coast, with headquarters at St. Augustine, Fla.

H. Smith, general inspector of the Wheeling & Lake Erie, has been promoted to general foreman of bridges and buildings, a newly created position.

W. H. Brown, bridge and building foreman on the Alton at Bloomington, Ill., has been promoted to master carpenter of the Eastern division, with the same headquarters, effective September 16, succeeding **E. Gephart,** whose death on September 13, is reported elsewhere in these columns.

John B. Harvey, roadmaster on the Denver & Rio Grande Western at Walsenburg, Colo., has been promoted to master carpenter at Alamosa, Colo., succeeding **G. C. Blackaller,** who has been transferred to Salt Lake City, Utah. Mr. Blackaller relieves **H. O. Adkins,** who has been transferred to Grand Junction, Colo. A biography of Mr. Harvey was published in the September issue, page 638, following his promotion to roadmaster.

Paul E. Strate, whose promotion to district supervisor of bridges on the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., was reported in the August issue, was born in Hamburg, Germany, on December 12, 1890, and entered railway service in April, 1906, as a section laborer on the Oklahoma division of the Rock Island. In April, 1911, he became a bridge and building carpenter and in December, 1917, he was appointed a pile driver engineer. Mr. Strate was promoted to bridge and building foreman in March, 1920, and on June 25, 1936, he was advanced to master carpenter of the Western division, with headquarters at Fairbury, Neb. In November, 1937, he was transferred to Cedar Rapids, Iowa, and on August 16, 1940, he was transferred to Rock Island, Ill. From October, 1941, to January, 1942, Mr. Strate served as acting district supervisor of bridges, with the same headquarters, returning to his position as master carpenter at Rock Island

(Continued on page 750)

Unnecessary Train Stops Delay Deliveries

Spring switches, particularly at ends of double track, passing sidings, yard entrance and departure tracks, and at locations where traffic must flow freely, avoid many unnecessary train stops. The high cost of a train stop is secondary today to the time lost in making deliveries. Under existing conditions, trains must be kept moving. Economy follows as a natural result.

The Racor Three-In-One Switch Stand combines in one compact housing the three distinct features required for the efficient operation of spring switches:

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on the latter date, which position he held until his recent promotion, effective July 18.

J. A. Jorlett, whose promotion to master carpenter of the Conemaugh division of the Pennsylvania, with headquarters at Pittsburgh, Pa., was reported in the August issue, was born on March 28, 1904, at Clifton, N.J., and attended Rutgers University and New York University, graduating from the latter school in civil engineering in 1929. He entered railway service with the Pennsylvania in July, 1929, as a draftsman in the office of the division engineer of the New York division. In April, 1932, he became a carpenter on the same division, being, in 1934, promoted to bridge and building foreman on electrification work on this division. In 1935, Mr. Jorlett left railway service to serve as chief of party on the construction of sewage disposal plants for the United States Resettlement Administration, returning to the New York division of the Pennsylvania in August, 1936, as a draftsman and field engineer. In April, 1938, he left railroad service to serve as an engineer on foundation construction work with the firm of Senior & Palmer, Inc., New York. In June, 1939, Mr. Jorlett returned to the Pennsylvania as assistant master carpenter of the New York division, holding this position until his recent promotion, effective July 1.

Obituary

A. S. Williams, assistant supervisor of track on the St. Lawrence division of the New York Central, with headquarters at Remsen, N.Y., died suddenly on September 4.

William B. Castle, who retired in the latter part of 1935 as supervisor of track on the Louisville & Nashville at Middlesboro, Ky., died of a heart ailment at his home in that city on September 9 at the age of 78.

Alvin C. Harvey, chief engineer of the New York, Chicago & St. Louis (Nickel Plate), with headquarters at Cleveland, Ohio, whose death on August 22 was reported in the September issue, was born at Mansfield, N.Y., on December 24, 1883, and graduated from Purdue University in 1908. Before his graduation from college he had been employed as a rodman and draftsman in the engineering department of the Nickel Plate, and he returned to that company in June, 1908, as a rodman and transitman on station ground surveys between Cleveland, Ohio, and Buffalo, N.Y. In March, 1909, Mr. Harvey was promoted to assistant engineer on a grade crossing elimination project, where he remained until March, 1910, when he was placed in charge of a double track survey in New York and Pennsylvania. A few months later he was placed in charge of track elevation at Grand Crossing, Ill., and in June, 1916, he was put in charge of field work on a grade crossing elimination project in Cleveland. Mr. Harvey was promoted to field engineer at Cleveland, in January, 1917, and in September, 1918, was promoted to engineer of grade crossing elimination, in charge of the west side grade crossing elimination at Cleveland. He was promoted to assistant chief engineer of the Nickel Plate district in December, 1921, and in August, 1924, was also given jurisdiction over the Lake Erie and Western District. On June 1, 1925, he was promoted to chief engineer, with headquarters at Cleveland, which position he held until his death.

Alvin C. Harvey

E. Gephart, master carpenter of the Eastern division of the Alton, with headquarters at Bloomington, Ill., died in that city on September 13 after a short illness.

Supply Trade News

General

The **American Hoist & Derrick Co.,** St. Paul, Minn., was presented the United States Maritime Commission award of merit on September 18 for outstanding achievement in war production.

Personal

W. G. McFadden, has been appointed acting manager of the Chicago office of the **Allegheny Ludlum Steel Corporation** to replace **P. E. Floyd,** now serving with the government.

R. J. Laidlaw has been appointed manager of the Cleveland, Ohio, district office of the **Worthington Pump & Machinery Corporation,** to succeed **A. J. Klug,** who has been assigned to special work with certain important industries in the Cleveland district. Mr. Laidlaw has been connected with the Worthington organization in various capacities since 1919.

John F. Van Nort, sales manager, Western division of the **Duff-Norton Manufacturing Company,** Pittsburgh, Pa., with headquarters at Chicago, has been promoted to general sales manager at Pittsburgh. Mr. Van Nort was born at Fairmont, W. Va., on July 27, 1898, and began his business career in 1922 as a salesman with the Oil Well Supply Company (a subsidiary of the United States Steel Corporation) at Pittsburgh. He later served in various capacities in the sales department of that company, including those of branch store manager and special representative of the Eastern division. In 1934 he was promoted to manager of Pittsburgh sales, with headquarters at Pittsburgh, which position he held until 1941, when he resigned to become Western division sales manager of Duff-Norton.

John F. Van Nort

Charles E. Wilson, president of the **General Electric Company,** has been appointed a vice-chairman of the War Production Board. **Gerard Swope,** former president of the company, whom Mr. Wilson succeeded, and **Owen D. Young,** former chairman of the board, have been recalled from retirement to resume those positions. **Philip D. Reed,** the present chairman of the board, is on leave of absence in government service.

Obituary

John S. Conover, who retired as assistant to the vice-president of the General Electric Company in 1931, died August 23 at Schenectady, N.Y. He was 78 years of age. Mr. Conover pioneered in the development of electric power in India and the trolley car in Germany.

Henry Etter Passmore, railway supply representative of the Frost Railway Supply Company, the Koppers Company—American Hammered Piston Ring division, and the Slaymaker Lock Company, at Pittsburgh, Pa., died on July 5. He was 72 years of age.

Harry T. Thompson, district manager of the Metal and Thermit Corporation, New York, died at his home in Mt. Lebanon, Pa., on August 19, at the age of 53. Mr. Thompson was born in Chattanooga, Tenn., and graduated from Georgia Institute of Technology in 1912. During World War I he served in France as a captain in the Field Artillery. After returning to civilian life, he became associated with the Differential Steel Car Company, Findlay, Ohio, and was later made a vice-president and director of that company, an association which continued until his death. In 1931, he joined the sales organization of the Metal & Thermit Corporation. Shortly thereafter, he was appointed district manager and placed in charge of the corporation's Pittsburgh branch, which serves the Central Atlantic and Southeastern states.

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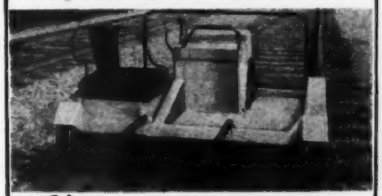
• Patented rail skids, mounted between the wheels 1" above rail, prevent car from straddling rail when being removed from track.



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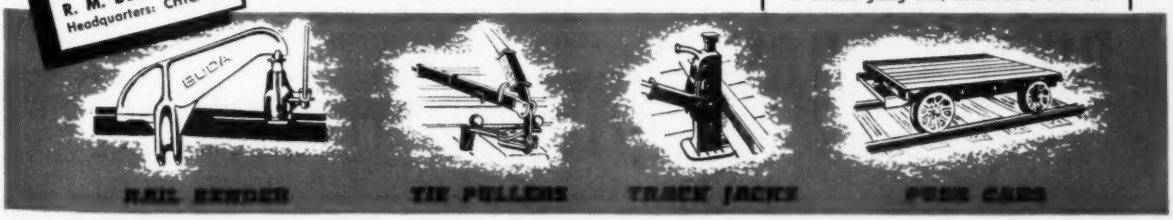

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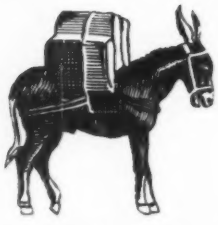

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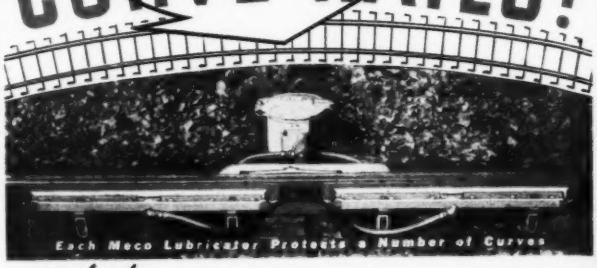

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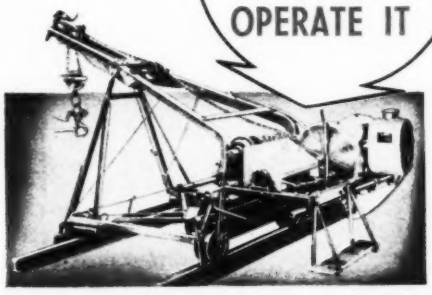

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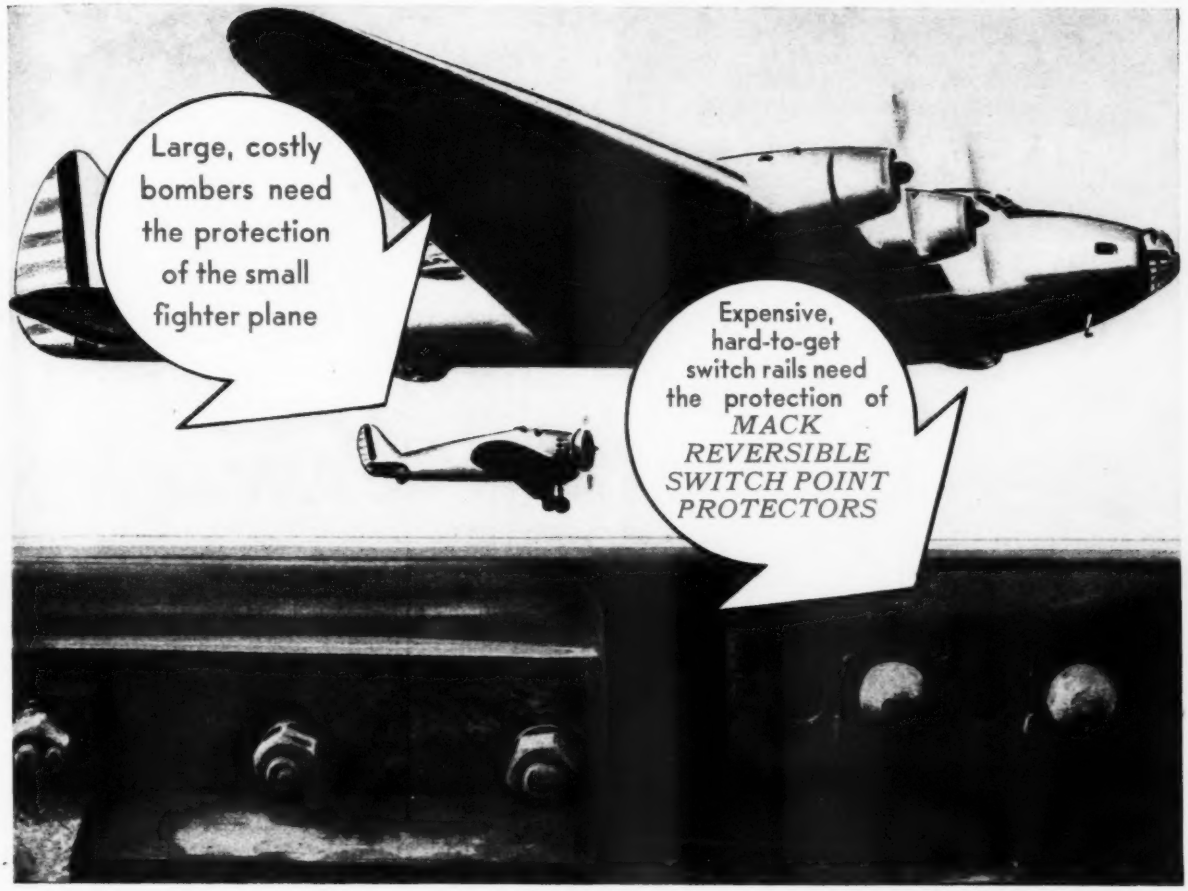
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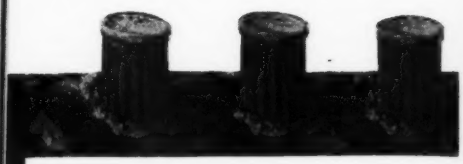

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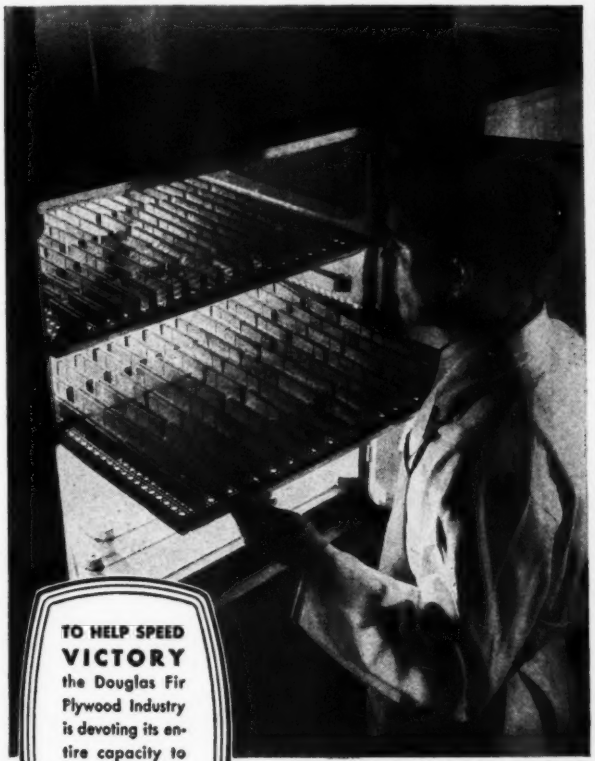

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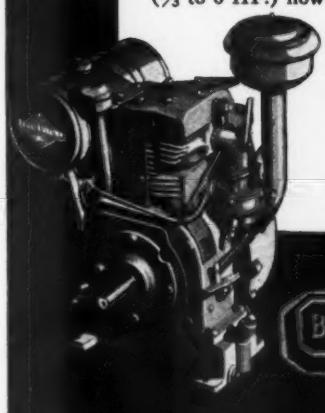

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Contours the roadbed
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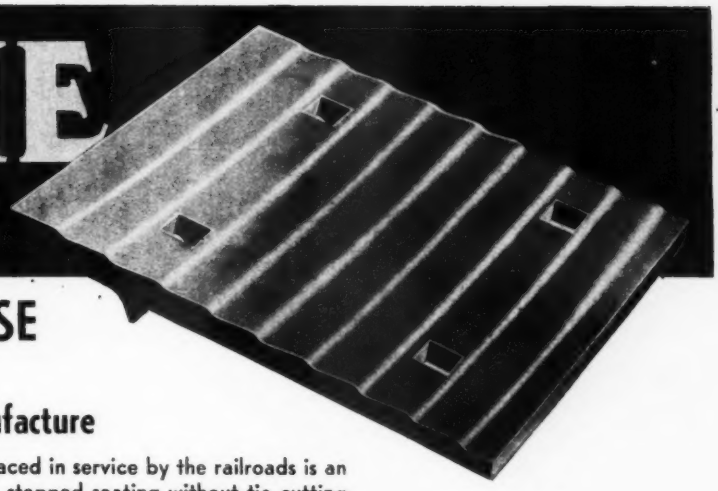

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Requiring 10% Less Steel to Manufacture

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Manufactured to A. R. E. A. Specifications **Furnished in Double or Single Shoulder**

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Rail and Flange Lubricators

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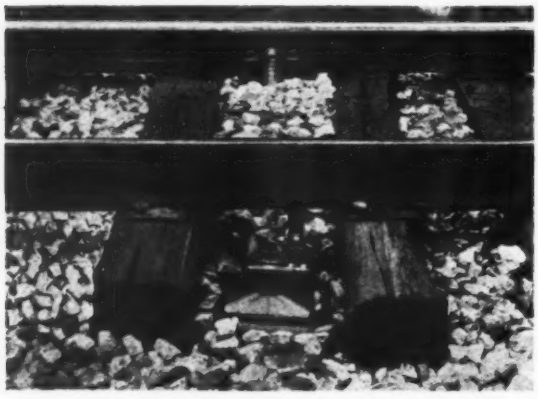

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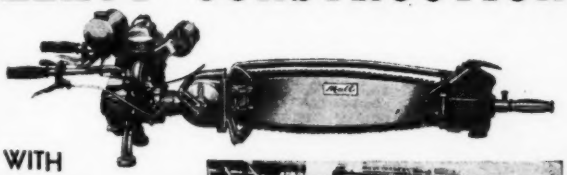

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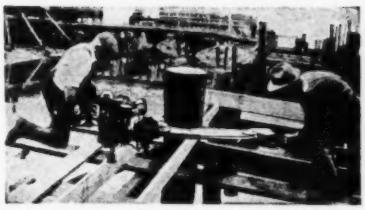

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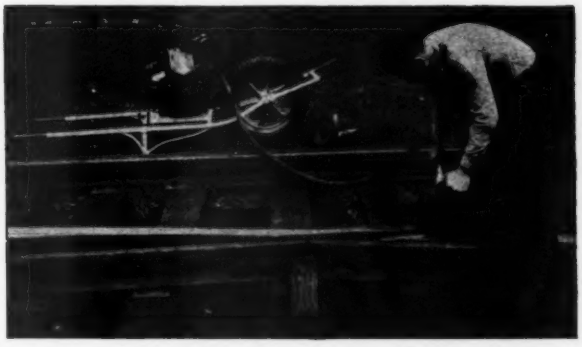

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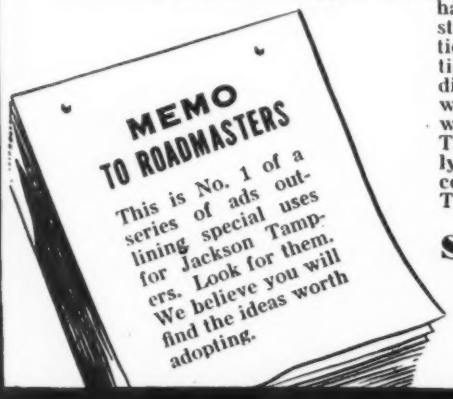
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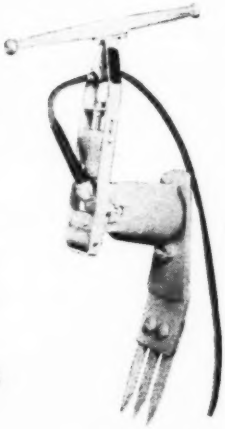

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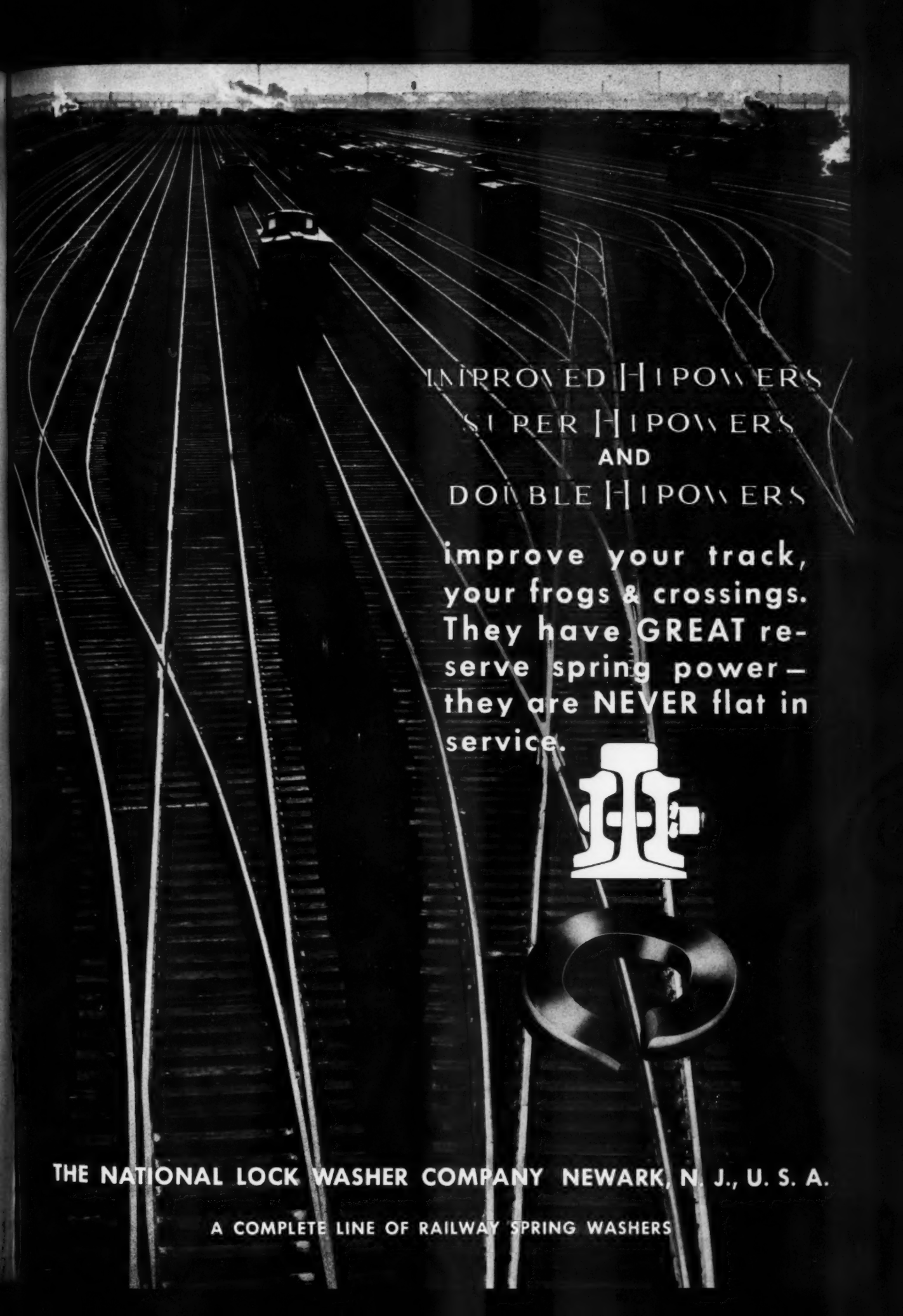
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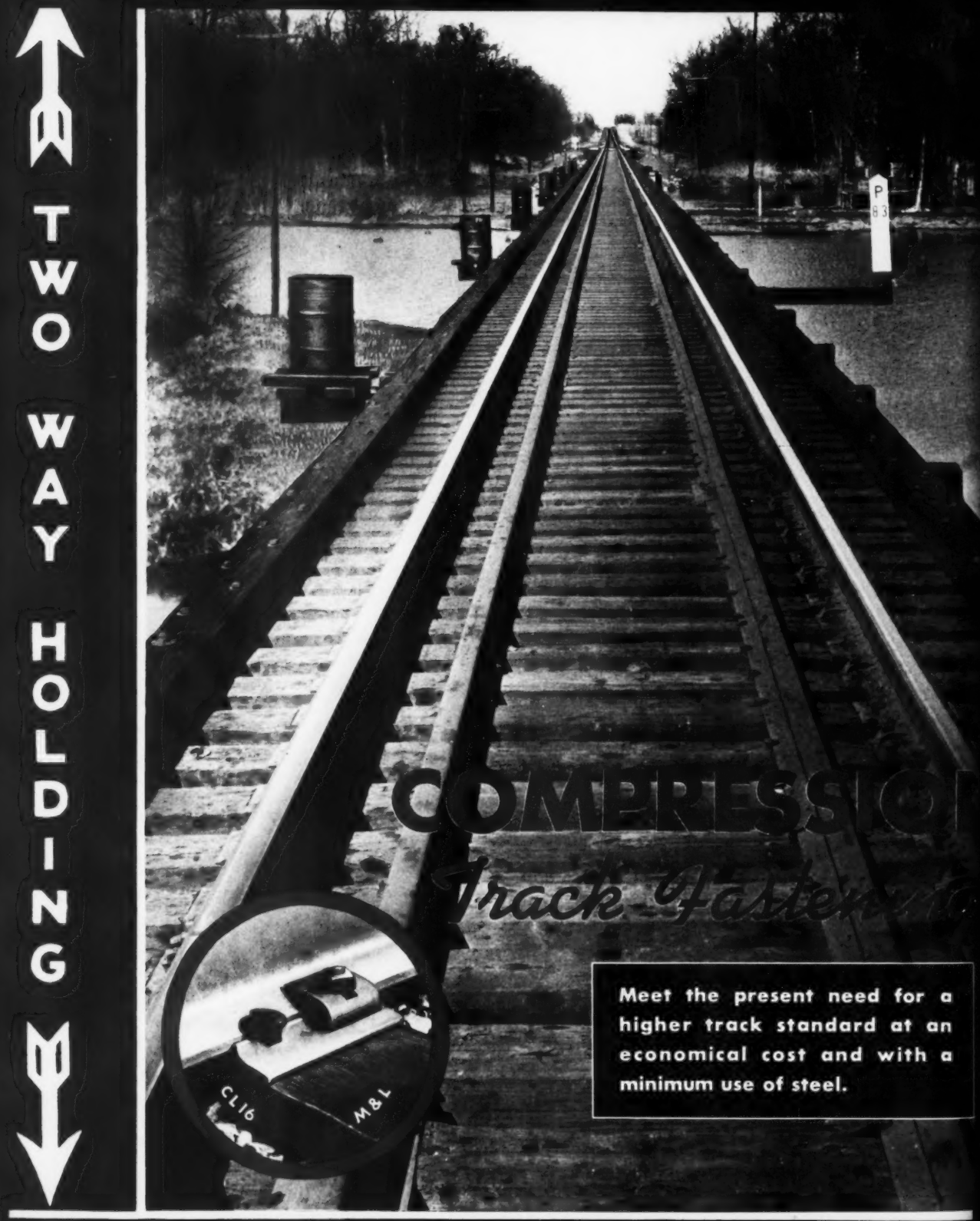

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